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**ENGLISH APPLIED
IN
TECHNICAL WRITING**

ENGLISH APPLIED IN TECHNICAL WRITING

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REVISED
EDITION

F. S. Crofts & Co.

New York

1932

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First printing, July, 1926
Second printing, September, 1927
Third printing, September, 1929

REVISED EDITION

Fourth printing, August, 1932

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MANUFACTURED IN THE UNITED STATES OF AMERICA
BY THE VAIL-BALLOU PRESS, INC., BINGHAMTON, N. Y.

TO
THE AUTHOR'S COLLEAGUES
IN THE TECHNICAL DEPARTMENTS

PREFACE

The specific use for which this book is intended and the philosophy upon which it is based are explained at some length in the Foreword. No novelty is claimed for so obvious an idea as the linking of certain phases of instruction in English with the written work done by students in their technical courses. The experience of numerous colleges over a considerable period has proved the essential soundness of the plan. Instead of being classed as an isolated subject, English has come to be regarded as an integral part of the curriculum.

Although the practical kinds of writing are emphasized in this book, the subject of composition is not treated in terms of "engineering English," or any other sort of occupational dialect. On the contrary, English is considered to be English, regardless of the subject matter with which it happens to deal. Most of the illustrations are drawn from familiar types of written work, because the specific problems of everyday writing represent the greatest need for the use of English and the best opportunity for giving the student a working knowledge of the fundamentals. At the same time, it is pointed out that the most effective expression, even in practical writing, cannot be achieved without a wide variety of literary experience. Along with the fundamental virtues of clearness and correctness the student is expected to develop resourcefulness and critical taste. He is constantly reminded of his need for an adequate cultural background, and of the literary values which are inseparably linked with the practical, or which lie just beyond.

The material in the book has been shaped in accordance with what long experience has shown to be the needs of the average technical student. Where the necessary adaptation has seemed to call for exceptional arrangement or unconventional style, these have been freely used. Even very elementary information has been included at certain points where it seemed to be needed. The result is, not a formal treatise, but a book of counsel and instruction.

English composition, in the final analysis, is always an individual problem. No two students have precisely the same combination of difficulties in English, and no two express themselves in exactly the same style. Because of large enrollments, the instructor finds it increasingly difficult to reach the individual. This is particularly true if a large part of the teaching time must be given over to the explanation of details which every student should learn for himself. The discussions in this book are meant to be read, understood, and applied by the student; and the exercises are designed to encourage him to become his own critic. It is hoped that in this way the book will free the instructor from much of his detail work and will aid him in his efforts to develop in the student a proper degree of literary self-reliance.

Material and suggestions have come from so many different sources that adequate acknowledgment of them can hardly be made. Owing to the close co-operation which has existed for more than twenty years between the English and the technical departments, my greatest debt is to my colleagues at the University of Cincinnati. Their cordial attitude has so favored the free interchange of ideas that virtually every recommendation made in the following chapters has been discussed with members of the technical departments. Another source from which I have drawn heavily is the Committee on English of the Society for the Promotion of Engineering Education. Especially during a

period of active service on this committee it was my privilege to ascertain the views of teachers and administrative heads concerning the general problem of English in engineering colleges. It is a pleasure to record here my appreciation of the very considerable assistance which I have received in this way. In fact, my indebtedness to all of the sources mentioned above is so great that my task as author appears to have been chiefly that of interpreting a policy and editing a body of material.

The quotations found in the book are used by the kind permission of the following authors: Dean Herman Schneider, Sir Arthur Quiller-Couch, Max Beerbohm, Dr. Edwin E. Slosson, Mr. John Mills, Professor Henry van Dyke, Mr. D. A. Wells, Mr. John Dockendorfer, Mr. Harvey Wiley Corbett, and Dr. H. R. Shipherd. The publishers who have courteously permitted the use of quoted material are the American Management Association, The Atlantic Monthly Company, The Century Co., Harper and Brothers, The Forum Publishing Company, The Iron Trade Review, Little, Brown and Company, G. P. Putnam's Sons, Charles Scribner's Sons, the U. S. Geological Survey, and The Westinghouse Electric and Manufacturing Company. Specific acknowledgment of the sources of quoted matter will be found in the text. Although it is not feasible to cite detailed quotations in the text, it should be noted here that the chapter on "Good Mechanical Form" owes much to the style books of several technical journals, particularly the McGraw-Hill publications and *Machinery*. In addition to the quoted matter that is definitely recognized as such, there is a great amount of material which has come, directly or indirectly, from my predecessors. In a book on English composition, more perhaps than in any other, may be found evidences of the author's previous reading.

For direct assistance in the preparation of the book my special thanks are due to my colleagues, Messrs. William

S. Wabnitz and Harvey E. Drach. Constructive criticism of the plan of treatment has come from Professor W. O. Birk, of the University of Colorado, and from Professor Sada A. Harbarger, of the Ohio State University. To Dean Herman Schneider, of the College of Engineering and Commerce, I am especially indebted for his consistent support of the plan of instruction on which the book is based. Even more helpful has been the inspiration of his example and his point of view. As a writer, both of scientific and of literary works, he has demonstrated to engineering students and others the relation between clear thinking and clear writing, and the all-round importance of a sound knowledge of English.

PREFATORY NOTE TO REVISED EDITION

Although numerous additions and substitutions are found in the revised version which follows, the general plan of the original book is unchanged. Necessarily, the main body of theory remains the same as in the earlier edition. In the treatment of details there has been a freshening of illustrative material and a shift of emphasis calling for more work to be done independently by the student. The exercises are designed particularly to encourage the analytical approach to composition. Observation has shown that many students, and graduates as well, fail to carry over into their writing the logic and precision of their scientific thinking. It is hoped that this text will assist such persons in bringing about a closer relationship between their thought and its expressions.

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FOREWORD

To the Instructor

Although English is taught during one or two years and within one department, it is used in all departments during every year of a student's college course. In recent years this fact has come to be generally recognized, and, as a result, there has been a growing emphasis on what the late Professor Samuel Earle called "institutional instruction in English."

Because English is an interdepartmental subject, the instructor has a vital interest in following the results of his work beyond the classroom. The immediate practical test of his instruction is that his students shall use clear, correct, and effective language in their everyday manuscripts. The ultimate test is that they shall form lasting habits of good expression. To bring about these results the teacher of English needs to work in close co-operation with the technical departments. Although it is his special task to teach the principles of composition, he must remember that these principles will be applied in connection with technical studies. His teaching will be more effective, therefore, if it is based on an understanding of the student's point of view and of his whole program of training.

The real teaching problem, of course, is the student, and not the subject. English, abstractly considered, is always *English*, and its fundamental principles remain unchanged. Strictly speaking, there is no such thing as "technical English" or "business English." There are applications of English, however, which are peculiar to the work of an

engineer or to that of any other professional man. In recognition of this fact, a part of a student's instruction should be given in terms of his particular needs. Such training should not exclude the general or cultural study of English. On the contrary, it should allow more time for general English by utilizing as exercises in composition certain kinds of writing which the student already does in connection with his technical studies. Since these compositions deal with subject matter which the student knows, and since they are written for a definite purpose, they are much better exercises than any "expository themes" written exclusively for the department of English.

Owing to his make-up and his interests, the technical student presents a somewhat special problem for the instructor in English, though he is far from being the hopeless or difficult problem that some would call him. True, he may lack a certain superficial showiness, for a scientific attitude is incompatible with either showiness or superficiality. He has a disciplined mind, however, and in the long run there is more hope for such a person than for one who is noted for sporadic brilliance. Thanks to his mathematical bent and training, he has learned to think clearly, and he has acquired a sense of structure and a certain amount of creative imagination. In his drawing classes he has learned the importance of accuracy and neatness. The instructor in English need only capitalize the student's equipment and use it as a basis for teaching him to translate his fundamental logic into accurate language.

What the technical student chiefly lacks is versatility. The subjects with which he deals are so uniformly matter-of-fact that he is likely to become rather literal-minded. In the more stubborn cases of literalness the student not only fails to appreciate allusions and other enlivening touches of style in the writings of others; he also misses

the finer shades of meaning. He may even be helpless in the face of unexpected difficulties like typographical errors, as was the student who searched vainly through the dictionary and the laboratory because of the statement printed in his manual that a "seaprate solution" should be used for a second experiment. The worst effect of such unimaginativeness, of course, is on its possessor's own writing. It commits him to a dead-level style that has neither force nor interest.

The technical student need not suffer from inelastic habits of thinking and expression, and as a rule the danger is potential rather than actual. An important function of the course in English is to combat any tendencies in this direction by developing in the student a certain degree of adaptability, or literary resourcefulness. The teacher is justified in devising unusual exercises for this purpose. If necessary, he should not hesitate to explode a literary bomb-shell occasionally in order to jar loose a set frame of mind or to awaken a slumbering imagination. This motive should be ample warrant for such unexpected assignments as may be described by the chapter title in Fielding's *Tom Jones*—"A Short Hint of What We Can Do in the Sublime." Although most of such exercises would naturally be found in a different type of English course from that comprised in this book, some recognition of them is merited here because of their contribution to any writer's general effectiveness. Even the most severely practical kinds of writing will be done better if the student adds versatility to the basic requirements of clearness and correctness.

As the reader has doubtless inferred, the chief emphasis in this book is on correct form and clear expression in everyday manuscripts, whether written for school or for industry. In considerable detail the book sets forth the qualities which such compositions have in order to be acceptable. Because it is recognized that the student must sooner or

later become his own critic, explanations and illustrations are made sufficiently full to give the book some value as a work for private study and reference, independent of class instruction. At the same time it is hoped that, wherever possible, the content of the book may be vitalized and supplemented by the give-and-take of classroom discussion. It is also intended that, where it deals with their common problems, the book may afford a working basis for co-operation between the department in which English is studied as a subject and the departments in which it is used as a tool of expression.

Such co-operation is facilitated by the organization of the technical college. A definite program of prerequisite and advanced studies lends itself particularly well to the forming of interdepartmental relationships. The technical departments need to get together often in order to avoid overlapping and to insure completeness and proper gradation in the scheduling of studies. At such times there is opportunity for the teacher of English to confer with the others regarding their common purpose and policy in the training of students.

How the details of co-operation shall be managed is purely a question between the teacher of English and the technical instructor concerned. Because local and even temporary conditions may enter largely into the working out of a particular case, the present discussion may well be restricted to general methods of co-operation. By utilizing the student's technical manuscripts as a basis for teaching certain phases of composition, the instructor in English can contribute directly to the improvement of his written work. The technical instructor may aid him in a variety of ways. He may call special attention to poor manuscripts, or he may refuse to accept, for technical purposes, a piece of writing which is not presented in reasonably good form. He may give special recognition to students whose manuscripts

are distinctively well written. The chances are that he would do this unconsciously, even if he did not do it of set policy. He may join with his fellow instructors in adopting forms and standards for laboratory reports, theses, and other types of written work common to the various departments. As a special precaution, he may require that a manuscript be approved by the instructor in English before it is submitted to the technical department.

Whatever be the method of co-operation, the technical instructor increases the efficiency of his own teaching at the same time that he encourages improvement in the written work of students. In the proportion that the illegible manuscripts which he has been trying to decipher are replaced by clearly arranged ones, he saves time and avoids eye-strain. Moreover, he has the satisfaction of knowing that the student shows greater respect for the subject and does better work in it when a high standard of expression is required. The effort needed to produce a clean-cut statement of his thought compels the student to do the sort of thinking that is essential in the study of a technical subject.

ENGLISH APPLIED IN TECHNICAL WRITING

CHAPTER I

THE POINT OF VIEW

At the first meeting of a class in any subject, the students have the right to ask, "Why are we here?" The instructor commonly anticipates this question by explaining at once the purpose of the course of study which the class is about to undertake. In his explanation he is usually careful to distinguish between primary and secondary motives and objectives. A secondary reason for studying a subject is that it is required, or, if another word sounds better, prescribed. The primary reason for studying it takes us back to the fundamental question of *why* it is required. A secondary objective which a student may have in taking a course is to obtain a passing grade. His primary objective is to gain something that will be a permanently useful part of his training.

In the spirit of the classroom, we may ask at the beginning of this discussion, "Why study English?" Unless this question is answered to our satisfaction, we shall hardly be interested in the later question of *how* to study it.

Of course, every teacher can talk with unbounded enthusiasm about the importance of his own subject as he sees it. The student would hardly be surprised, therefore,

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to encounter at this point a chapter of eloquent preachments that would be an endorsement, and perhaps also, an exhibition, of English. However, he will be spared such an endorsement, because, among other good reasons, it seems preferable that he should look at the subject from a different angle. Instead of being asked to appreciate English from an English instructor's point of view, he will be expected to appraise it from the standpoint of his own present and future needs. Any outside testimony that is drawn upon will be offered by scientists, engineers, business men, and others who judge English impartially on the basis of its practical value.

In the first place, it should be noted that English was put into the schedule by a faculty consisting of technical men. They chose English, along with each of the other subjects, as a part of a carefully considered program of professional training. They intended that every student should have not merely a book knowledge of the subject, but a working knowledge, to be used both in his advanced study and in the practice of his profession. The first-year engineering student who is impatient to design machinery or to preside over a transit, discovers that he must wait until he has completed a number of preliminary studies, such as drawing and mathematics, which are not themselves engineering but are indispensable to the study of engineering. By making English a requirement the faculty affirms that it belongs to the group of fundamental, prerequisite subjects which are to be mastered at the beginning in order that they may be applied in the later work of the engineering course.

Although the purpose of the faculty is thus clearly indicated by their inclusion of English in the program, it is sometimes explicitly stated, as in the following resolutions which were adopted by a group of engineering teachers:

It is believed that the requirement of a uniform standard of expression in all departments will be of advantage to students as well as to instructors. Only when the student has put his material in presentable form and has made his meaning clear, can the soundness of his conclusions be tested. Every piece of writing, therefore, whatever its subject, is first an exercise in English.

The instructor in any subject has a right to insist that a written exercise be correct in form and clear in expression before the merit of its content is considered. It is manifestly unreasonable to expect the instructor to decipher illegible manuscript, rearrange illogical combinations of data, overlook inaccuracies, and give the student the benefit of a hundred doubts. In all cases, credit can properly be given only for what the student has actually said, and not for what he might have said if he had formed a clearer idea of the subject, or if he had taken more pains to express his meaning.

If careless writing is an imposition on the instructor, it is a far greater detriment to the student. Written work, if properly done, trains the student to be accurate, neat, systematic, and capable of consecutive thinking; and therein lies much of its value. If the work is carelessly done, not only is this training lost, but the student becomes confirmed in bad habits of expression which no single course in English composition will suffice to correct.

It is recommended, therefore, that all engineering students be required to maintain a definite standard of expression *in all their written work*, and that a grade in English, based on non-English subjects, be given each student for each term throughout his course.

Whether or not there is a regular and formal check-up on the student's working knowledge of English, as shown by the writing which he does in his technical studies, the general standing of every student is inevitably affected by the quality of his written work. The technical instructor cannot avoid being influenced, favorably or unfavorably, by the form of a manuscript. Every piece of writing, whether it consists of a single-sentence answer to an examination question, or of an elaborate report, is an opportunity for the student to demonstrate his working knowledge of English. Incidentally, it is also an opportunity

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for him to form habits of expression that will be directly useful in his professional career.

When we speak of English as an "applied" subject, we have in mind, of course, both immediate and ultimate applications. If the student is not required to show a high standard of performance in his written work during his college course, he can hardly hope to change his habits all at once upon graduation. And if he does not change them, he will be seriously handicapped in his competition with others who use English well enough to make it serve their professional purposes.

An instance reported by a former student shows how a narrowly trained engineer discovered the economic value of a working knowledge of English. As superintendent of a department in a manufacturing plant, this engineer had shown a high degree of competence. In recognition he was promoted to a more responsible position and was given a salary increase of fifteen hundred dollars a year. The new position called for supervision over a wider area. Whereas he had formerly gone about within one department, giving personal attention to details and issuing orders by word of mouth, he now remained in a central office, in which he received reports and from which he issued written instructions.

He made a valiant effort to live up to his new position, but, although his technical qualifications were ample, his narrow preparation in English got the better of him. Here is a copy of one of his laboriously dictated communications—a striking example of linguistic inefficiency in a man who was technically efficient:

The writer wishes to bring to your personal attention the officiated importance of such oil known in form as crude oil pertaining to transferring of same from new cars to storage tanks, etc. The writer in part feels and further states, that more efficient

service rendered from your office will be fully appreciated, by all concerned, on account of past demurrage on recent oil cars, forces notes of attention, advising a more speedy transferring of same to avoid this unnecessary condition which is at this time to be found prevailing. One day service in transferring oil to reserve tanks in the opinion of the writer with your representing and efficient maintenance generally is a well balanced time stated to adjust above matter to some significant degree.

Respectfully,

If the written work connected with a job is well done, the copies which are kept in the files constitute the best possible evidence in favor of the man who wrote them. Unfortunately, however, this rule works both ways. If the written part of an employee's work is poorly done, the files bear witness to his shortcomings and accumulate permanent evidence against him. Of course the writer of the letter quoted above soon went back to his old position. Capitalizing his loss in salary at five per cent, we may conclude that, for this man, the ability to use English would have been equivalent to a deposit of thirty thousand dollars in the bank. How much more his insufficient training may have cost in barring him from further advancement can only be conjectured.

Such a case is by no means unusual. Of the factors which limit an engineer's advancement, inability to use English is generally agreed to be the most common and the most serious. Those who train and those who employ engineers may differ in their opinions regarding some subjects taught in engineering colleges, but they are unanimously in favor of giving every student a thorough course in English. They realize, too, that it is not merely a question of preparing him to dictate a few letters in such a way as to avoid becoming ridiculous. More often, his personal advancement and his usefulness in his professional life will depend upon his ability to use English, not merely with ordinary correct-

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ness, but with considerable skill. His written work will often constitute an important part of his credentials, to be submitted along with an application for a position. Even student manuscripts have proved useful for this purpose. Then, in connection with his work, he is expected to write articles, in order to share his professional experience with others and to establish a record of what he has accomplished. He may also be obliged to translate engineering concepts into language that is intelligible and interesting to financiers, stockholders, voters, and other laymen whose support he must have before he can go ahead with the development of an engineering project.

The following advertisement from an engineering journal illustrates a specific need for an engineer who combines writing ability with his technical knowledge:

WANTED—A man of engineering training who is effective as a speaker, as a writer, and in personal relationships, to assist in making the public acquainted with the engineering and practical features of a large public improvement. Services will be necessary for several years. The aim is to educate the public, to maintain a live interest, and to remove prejudice. The method will be complete publicity—personal interviews, newspaper publicity, and public talks. Necessary qualifications are tact, thorough integrity, a good personality, engineering judgment, careful preparation, and ability to present facts convincingly. The demand is for a man who will be the dependable source of information for the public, and not for one with a faculty for “putting things over.”

As this advertisement indicates, the demand is not for a publicity expert from outside the engineering profession, but for an engineer who can use English well enough to make his technical knowledge effective. A particular engineering student may not believe at the moment that he

will ever hold such a position as the one described, but every engineering graduate who does not wish to limit his own future should be able to use language well enough to meet the specifications given. Unless he is content with a job at drafting, detailing, or some other "silent partner" type of work which is not really engineering, he cannot long escape the necessity of using English. The writing of letters, reports, instructions, specifications, and articles, to say nothing of sales and publicity matter, will call for all the literary resourcefulness which he can command.

"But," some one may suggest, "it is not every one who *can* learn to use language well." Strangely enough, some people who are otherwise practical are inclined to look upon writing as a "natural gift," which requires no effort for favored persons and is difficult or impossible for others. Probably they would not go so far as to maintain that a divine afflatus guides the successful writer and requires only that he hold pen to paper in order to produce a masterpiece. And yet their assumption of a special talent is almost as absurd. Any writing that is worth while, whether it is done for literary or for practical purposes, calls for hard work. A student who will give the same close study to his English that he gives to his mathematics *can* produce a reasonably good piece of writing. To assume that writing is "naturally" easy for some persons is to withhold credit from those who have earned it; and to take for granted the hopelessness of others is to encourage a very common form of satisfied laziness.

The whole matter was once effectively stated by a scientist to whom a student had submitted an unacceptable manuscript. With the air of one who expects consideration for a natural deformity the student explained that he had never been able to "get" languages.

The scientist's reply seemed at first to be sympathetic.

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He said, "It is true that there are a great many persons who are constitutionally incapable of learning to use language well, and it is also true that many of these are excellent and useful citizens. But," he added, significantly, "such persons do not expect a college degree."

If a student is convinced that he needs a working knowledge of English, and that he can gain such knowledge by putting forth the necessary effort, he is ready to consider specific objectives. He may very properly inquire at this point, "What constitutes a 'working knowledge' of English? What are the standards of expression that must be consistently met in the preparation of written work?" In proportion as the answers to these questions become clear to him he will be able to improve his own writing.

To begin with, a piece of written work should have good mechanical form. That is, the manuscript should be neat, legible, and correct, and the relation of one part to another should be made evident by indentions, punctuation marks, illustrations, and other mechanical aids to clearness. In order that the parts of the composition may have proper connection and sequence, the material must be carefully organized on the basis of a clear plan and a definite purpose for the whole composition. The individual statements which combine to make up the composition should be clear, definite, and concise, and they should be logically grouped and smoothly connected. The style of the composition should be consistently appropriate to the writer's purpose and to the subject matter. For the sake of both the meaning and the general effect, the words used should be chosen with due regard for their associations as well as for their definitions.

In the first part of this text the foregoing specifications for written work will be discussed in some detail. Since college students differ widely in their preparation in Eng-

lish, many of the elementary matters discussed will doubtless be familiar to those who are well prepared. Even so, a review can do no harm. For those who have been less fortunate in their training the rather brief discussions may possibly be insufficient, but it is hoped that they will at least indicate the supplementary study that will be necessary.

In Chapter IX, under "Types of Written Work," are described some of the principal uses which the technical student finds for a working knowledge of English. Most of these examples of "applied English" are drawn from the regular routine work done by the student in connection with his technical studies. They are not exercises in English as such, but they illustrate the normal way in which any one's knowledge of how to write is put to practical use. For this reason such routine compositions and the corresponding examples in Chapter XII are the best possible exercises in writing.

Finally, in the chapter on "The Technical Writer's Literary Background," there are a few suggestions regarding the more ambitious, though in reality not less practical, kinds of literature with which the student should be acquainted, and for which, it is hoped, a great deal of time will be found in his other English courses. In learning to use the library, he will extend the bounds of his knowledge and will thus become able to write with greater confidence and with a richer fund of information and allusion. Especially, in enlarging his literary background, he will gain resourcefulness in the use of language, and, what is more important, he will develop that power of creative imagination which belongs no less to engineers than to writers and artists.

CHAPTER II

GOOD MECHANICAL FORM

EVEN though a reader's interest is wholly in the subject matter his first impression of a piece of writing is necessarily based on its general appearance. If the manuscript is neat and well arranged, and if it has a clean-cut, finished look, any one who picks it up is predisposed in favor of the writer and his work. The content, upon being closely examined, may prove to be disappointing; but it will need to be strikingly poor in order to wipe out entirely the favorable impression which was created at the start by its good mechanical form. On the other hand, if a manuscript is illegible, untidy, scrappy, or incomplete, the reader's reaction is certain to be unfavorable. The subject matter will need to be exceptionally good in order to overcome the reader's adverse opinion.

The chances are that the content of a poor manuscript will not be exceptionally good, and that the subject matter of a good manuscript will not prove disappointing. A person who is accurate, definite, and consistent in the treatment of "mere externals" can hardly fail to show the same characteristics in his thinking. In fact, the two are so closely related that one of the best methods of cultivating orderly habits of thought is to give close attention to the details of mechanical form.

Of course, no one should find it necessary to concentrate very long upon externals. Such phases of composition should be studied intensively at the beginning, in order that

they may be handled later on without conscious effort. They are important aids to the writer in making his meaning clear, but they should never compete with the central thought of a composition for the writer's attention. If questions of mechanical form were not settled rapidly and almost automatically no one could hope to make any progress in writing. There would be so many decisions to make, if every point were deliberately reasoned out, that the writing of a single sentence would be well-nigh impossible. The spelling of a particular word or the placing of a punctuation mark might be disputed until the subject of the composition proper would be forgotten. Instead of developing a positive attitude toward his subject the writer would become hopelessly tentative and hesitant.

Of course, every issue must be decided. The truth is that for the average writer such points have been settled already. Correctness in disposing of them has become second nature. In so far as the details of mechanical form have not already been mastered they can be easily and rapidly learned, because the learning process is largely imitative. The repeated and accurate copying of approved models and the observance of a few basic rules and principles will give any one sufficient control over the external forms of composition to enable him to write with confidence and with comparative ease.

A writer's efficiency, then, depends upon his having a positive attitude toward mechanical details and the ability to deal with them unhesitatingly according to some definite practice. Since he is using these details for the reader's benefit, it is obviously important that his practice shall conform to the standards which have been established by usage. In his own notebook, by special arrangement with himself, a writer may use abbreviations and code forms that he has invented. In a composition which others are ex-

pected to read, he should be careful to use only such forms as are generally understood and accepted.

For the sake of definiteness, the recommendations for standard practice are here stated chiefly in the form of hard-and-fast rules. It is recognized that differences of opinion exist with regard to some of these rules, and that the practice of particular instructors, institutions, publications, and business offices may vary from what is here recommended. If their practice is definite and consistent, and if it does not run counter to recognized usage, there is no reason why it should not include different methods for handling details. Nor will the student need to be confused if he is obliged at any time to learn new rules or to adopt new forms. He will find it comparatively easy to change from one system to another that is equally definite; whereas he will find it almost impossible to change from no system at all to any definite system whatever.

One reason why absolute and permanent uniformity cannot be expected is that we are dealing with a living language which is employed by a constantly growing profession. Usage does not bind any one to fixed rules, but merely reflects the developments which time always brings. These developments may represent general tendencies, such as the modern preference for fewer capital letters¹ and punctuation marks, or they may represent particular changes dictated by reason or caprice. Specific questions are raised by such words as "formula," "gauge," "bessemer," and "horsepower." Shall the plural of the first be written "formulas," or shall the Latin plural "formulæ" be re-

¹ An apparent contradiction of this preference may be found in the rules for the writing of headings and subheadings in everyday manuscripts (p. 16). Since variety and contrast between parts of the text cannot be obtained so easily in typewritten or handwritten as in printed matter, the use of capital letters may be desirable as a feature of display, or page layout.

tained? Shall "gauge" be written in the simplified form "gage," or shall the older spelling be used? Shall "bessemer" be written with a capital "b," or has it become a generic term instead of a proper adjective? Which of the three forms, "horse power," "horse-power," or "horsepower," shall be adopted, if we are to ignore entirely the expression "a horse's power," which is used consistently by an eccentric writer?

It may well be suggested that, as far as any single example is concerned, the form which we adopt is not a matter of life or death. Our general attitude toward such questions, however, is highly important. It is worth while to know that "formulas," "gage," "bessemer," and "horsepower" have the preference among present-day technical writers, and to feel a sense of assurance in our own use of these and other doubtful forms. As we have seen, such issues cannot well be debated during the course of our writing. The time to consider them in detail is when we are discussing mechanical form. Then, having settled them once for all, we can dismiss them comfortably and can give our attention to the major problems of composition.

In the examination of the specific rules and forms, one or two cautions should be observed. Very often the reason for a given rule is found in usage or in practical common sense rather than in fine-spun logical reasoning. In a class discussion a student once objected to the spelling "gage" for a word meaning measuring instrument, on the ground that this word means a pledge of battle. So it does, in tales of chivalry, as other members of the class pointed out; but there can be no possible confusion of such a meaning with the technical one in a discussion of steam gages. It is simply a question of contexts.

A final caution is needed against the idea that the rules which govern form are the invention of textbook makers,

who have thus arbitrarily foisted their own whims upon some one else. As a matter of fact, the rules only summarize the current practice of technical men, and particularly of those who are responsible for the forms of expression used in engineering books and periodicals.

WRITING MATERIALS

Although it might seem unnecessary to mention anything so obvious, experience has shown that the importance of proper writing equipment is frequently overlooked. A little attention to seemingly negligible matters of this kind may be all that is necessary to make a manuscript neat and legible. Students who are accustomed to using india ink on white drawing paper will appreciate the legibility of black or dark purple ink, or of a fresh black typewriter ribbon, or of soft black lead for pencil-written manuscripts. It is purely a question of contrast between the writing medium and its background. The paper should be clear white and should have a smooth finish and a firm texture. Medium weight is preferable, and, except for special uses, the sheets should be 8½ by 11 inches, which is the standard size for note-book paper and letterheads. Ruled paper is used for handwritten, and plain paper for typewritten, work. The sheets are left flat, instead of being folded, and are held together by means of paper clips. If the sheets are bound in covers, they are fastened together by brass split rivets inserted from the back and flattened, or spread, inside the front cover.

THE PAGE LAYOUT, OR DISPLAY

Placing a section of text on a page may be compared to designing the layout for a unit of advertising. In each case the chief requisite is optical convenience for the reader.

The problem is to arrange the material within the allotted space so that the reader can follow it with the least possible effort. To this end, the body of the text is set off by a frame of margins, or "white space," and the relation of the various parts to one another is indicated by means of headings, indentions, underscorings, and other mechanical aids to clearness. The writer has not the printer's advantage of leading the text and using different sizes and styles of type, but he can employ a surprisingly large number of devices to emphasize his meaning and to give his page a pleasing symmetry. On pages 18, 19, 20, and 21 are illustrations of the details of layout which are given in the following rules. The student is advised to copy these pages as an accuracy test, rewriting each page entire as often as he makes one mistake or more, until his copy is one hundred per cent accurate. Then he will be able to use the same forms unhesitatingly in the preparation of his own manuscripts.

Writing space. As a rule, only one side of each sheet of paper is used. However, a class exercise covering not more than two pages is preferably written on the front and back of a single sheet.

Page numbering. Pages should be numbered in the upper right-hand corner of each sheet, and the sheets should be arranged in sequence before they are fastened together.

Space between lines. In typewritten work, the straight text is double-spaced, in order to make the manuscript easier to read and easier to edit, or revise. In handwritten manuscripts, each ruled line between the upper and lower marginal limits is used.

Margins. The left-hand margin follows a vertical line one and one fourth inches from the edge of the sheet, thus allowing space for binding and for marginal notes. The right-hand margin, although slightly uneven, is never narrower than three fourths of an inch. To avoid crowding the right-hand margin, words should be carefully divided at the end of the line or carried to the line below. (See "Division of Words," p. 17.) On standard ruled paper, the boundary of the left-hand margin is shown by a red line.

The margins at the top and at the bottom of the page should be one inch wide. The last line of a ruled sheet should be left blank.

Indentation of paragraphs. Paragraphs are indented one inch to the right of the left-hand margin. If the manuscript is typewritten, paragraphs are indented ten spaces for the double-spaced, and five spaces for the single-spaced, passages.

Sectional headings. Sectional, or main, headings are placed in the middle of the page, with a distance of two double-spaced lines above and two below. Important words begin with capital letters. No punctuation is used after the last word. Each word is underlined.

Subheadings. Subheadings are placed at the left, starting at a point midway between the margin line and the beginning of the paragraph. They are written on the line between the paragraph which they follow and the one which they introduce. Each word in the subheading is underlined, and all important words begin with capital letters. No punctuation is used after the last word.

A subheading should not be used unless it introduces one or more complete paragraphs of text. In other words, by putting down a subheading, the writer agrees to supply at least a paragraph of material.

Quotations. A quoted passage more than three lines in length is set in; that is, its first line is indented eight typewriter spaces (in handwritten manuscripts, approximately three fourths of an inch) from the left-hand margin. A separate left-hand margin line is established for the quotation, three typewriter spaces inside the regular margin line. The quoted passage is written single-spaced, and its paragraphs are indented five typewriter spaces from the interior left-hand margin line.

Tabulations. Columns of figures, lists of items or topics, and other units of tabular matter are centered horizontally on the page and are single-spaced.

Formulas and equations. Formulas and equations are dropped to the line below the one in which they are introduced, and are centered horizontally on the page. (See page 20.)

Illustrations. Sketches, photographs, and other illustrations are placed immediately adjacent to the text which refers to them. Illustrations covering less than half a page are framed by text. (See page 21.)

Footnotes. Footnotes are single-spaced, are centered horizon-

tally, and are placed three spaces below the last line of the text. Reference to them is made by numbers.

Division of words. Words which cannot be completed at the end of the line should be divided according to syllables, so that the beginning of the line below will not be misleading. For example, "equilateral" should not be written.....equilateral, but.....equilateral. Doubtful words should be carried entire to the next line, or better, they should be looked up in the dictionary.

Legibility of handwriting. Careful attention should be given to the slant, the looping, and the spacing of letters, and to the spacing of words. Neither elaborate flourishes nor laboriously drawn vertical letters are desirable. The writer's chief aim should be to separate, and thus identify, his letters and words. Compare the following examples:

*Legibility of handwriting depends on the slant, the looping,
and the spacing of letters, and on the spacing of words*

*Legibility of writing depends on the slant, the looping,
and the spacing of letters, and on the spacing of words*

Through practice, any one can readily acquire a style of penmanship that is both legible and fluent.

The following pages, which illustrate the rules for layout, or display, should be carefully copied and should be regularly used as models for the arrangement of text.

THE USE OF ABBREVIATIONS

It is a good general rule that abbreviations should not be used in connected discourse. For example, a writer who ends a sentence with "etc." is commonly held to have committed an offence against good taste. The ending is bad, partly because the sentence tapers off into a vague expression, and hence lacks emphasis. What chiefly offends, however, is the use of a substitute for ordinary language.

[Turn to page 22.]

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Specimen page layout, showing the arrangement of a typical contents page.

C O N T E N T S

Page

The General Plan

Principal Products

Location and Layout

The Power Plant

The Coal Supply

The Engine Room

The Paper Mill

Sources of Pulp

The Beater Engines

The Cylinder-Board Machine

The Drying Section

The Finishing End

The Laboratory

Tests of Raw Materials

Control of Processes

Specimen page layout, showing the placing of headings and tabular matter.

Surface Hardening of Steel by Nitriding

Recent developments in metallurgical science have made possible a method of case-hardening special steels by placing them in an atmosphere of ammonia gas. This process, which is known as "nitriding," has a number of advantages, chief among which are the following:

- (a) A very hard case is produced;
- (b) The parts treated are comparatively free from distortion;
- (c) The surface shows remarkable resistance to corrosion and to the wear of metal-to-metal contact.

This combination of results has made the nitriding process a popular one, notwithstanding the comparatively short time in which it has been in use.

Selection of Steels

Investigators have found that not all steels can be nitrided successfully. In general, the best steel for nitriding purposes has been found to consist of an alloy containing chromium in small amounts, with about one per cent of aluminium. The analysis of such an alloy is shown in the table below:

Carbon.....	0.10 to 0.45	per cent		
Chromium.....	1.60	"	1.70	"
Nickel.....	0	"	1.80	"
Manganese.....	0.60	"		"
Silicon.....	0.25	"		"
Aluminium.....	1.00	"		"
Sulphur.....	0.02	"		"
Phosphorus.....	0.02	"		"
Molybdenum.....	0.25	"		"

Various other alloys are equally suitable for nitriding, but the foregoing may be taken as a typical example. On the basis of data now being collected, these percentages will probably be somewhat revised. Any changes made will be included in a later report.

Specimen page layout, showing the use of double-space and single-space typing and the position of headings and chemical equations.

Baking Powders

Baking powders differ in their chemical composition. They are usually classified, according to their acid constituents, into the following kinds:

Tartrate powders, in which the acid constituent is tartaric acid in some form;

Phosphate powders, in which the acid constituent is phosphoric acid;

Alum powders, in which the acid constituent is furnished by the sulphuric acid contained in some form of alum salt.

All of these kinds contain bi-carbonate of soda, from which carbon dioxide is obtained, and all use starch as an absorber of moisture. The less starch used, the better the powder. However, a powder with too little starch will decompose readily.

Tartrate Powders

The form in which tartaric acid is usually furnished in baking powder is bi-tartrate of potassium or "cream of tartar." Bi-tartrate of potassium contains one atom of replaceable hydrogen, which gives it the acidity that acts upon the carbonate. The reaction takes place according to the following equation:



The residue, potassium-sodium tartrate, is among the least objectionable of any of those left by a baking powder.

Phosphate Powders

The phosphoric acid used in baking powders is commonly supplied by acid phosphate of lime. The pure salt is monocalcium phosphate. The reaction which occurs when a phosphate powder is dissolved, that is, the action of bi-carbonate of soda upon mono-

Specimen page layout, showing the framing of small illustrations within the text, and the placing of figure numbers and titles for their identification.

3

By this means the company keeps a constant check on its purchases, and safeguards the quality of its product. In the laboratory, analyses are regularly made of incoming shipments of materials, including coal, pig iron, dolomite, and limestone.

Coal Sampling

Coal is analyzed in order to determine its content of moisture, sulphur, and ash. A reliable indication of the presence of these three objectionable features may be had by "sampling" each car of coal and testing small portions. As a means of ob-

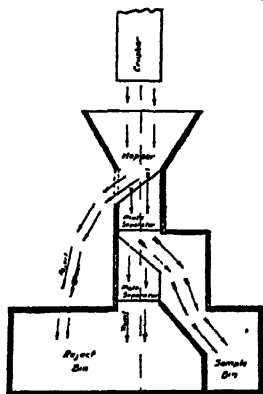


Fig. 2
Cross Section of an automatic chute
for quartering coal samples

taining representative samples, three trenches, eighteen to twenty inches deep, are dug, one at each end and one in the center of the car. A small quantity of the coal, about one-third of a bucketful, is taken from the bottom of each trench.

After it has been thoroughly dried, the sample of coal is ground in a rotary crusher. Immediately below the crusher is an automatic chute which quarters the finely ground coal and deposits a sample ready for the testing laboratory. The operation of this chute is shown in Figure 2.

It is usually advisable to make drawings on a separate sheet of paper or on a strip of tracing cloth, and then to paste them on the typewritten page within a space which has previously been outlined by text.

A page of text that is filled with abbreviations looks unfinished. It resembles a code message, a set of notes, or a tabular statement, rather than a fully developed piece of connected discourse. For this reason, careful writers not only refrain from using such arbitrary symbols as the ampersand (&) in their finished manuscripts, but even avoid putting down such recognized abbreviations as "e. g." or "i. e." when they wish to say "for example" or "that is." The saving in space does not compensate for the ragged appearance of the text.

The foregoing rule applies to connected discourse in general, but is subject to numerous exceptions in technical writing. In routine, matter-of-fact contexts, such as laboratory reports, interdepartmental correspondence, printed instructions, and other forms in which certain expressions are frequently repeated, the use of standard abbreviations is plainly dictated by common sense. It is difficult to imagine a practical person constantly and laboriously repeating "revolutions per minute" or "British thermal units," when he might say with equal clearness "r. p. m." or "B. t. u." In fact, so accustomed are engineers to the use of the shorter expressions that they think in terms of the abbreviations and are scarcely conscious of the expanded forms. In routine chemical discussions, written by and for the initiated, symbols are regularly used instead of complete words, as CO_2 for "carbon dioxide," H_2SO_4 for "sulphuric acid," NH_4OH for "ammonium hydroxide." Physicists and mathematicians find it very convenient to substitute a compact form like 10^{12} for its expanded numerical equivalent, 1,000,000,000; or 10^{-6} for $\frac{1}{1,000,000}$

No one who has a sense of proportion would advocate writing out such expressions in words or numerals when their meaning is equally clear, or perhaps more readily com-

prehensible, in the shorter form. It is a question of adapting what is said to the reader's point of view, and to the purpose for which the manuscript is intended.

Only authorized abbreviations should be used. Among the more common forms which have gained general acceptance are the following:

alternating current	a. c.
ampere	amp.
barrel, or barrels	bbl.
(See note on plurals under "Cautions," p. 24)	
Birmingham wire gage	B. w. g.
brake horsepower	b. hp.
British thermal unit	B. t. u.
candlepower	cp.
compare	cf.
Centigrade	C.
centimeter	cm.
chemically pure	c. p.
cosine	cos
cubic	cu.
cubic centimeter	c. c.
direct current	d. c.
electromotive force	emf.
figure, Fig., ²	plural, Figs.
foot	ft.
gallon	gal.
horsepower	hp.
inch	in.
kilovolt-ampere	kva.
kilowatt	kw.
kilowatt-hour	kw.-hr.
pound	lb.
logarithm	log
meter	m.
minute	min.

² This abbreviation is usually written with a capital "F," though the word "figure" is not. The same practice is observed in "No." and "number."

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millimeter	mm.
number, No.,	plural, Nos.
ounce	oz.
page, P.,	plural, pp.
per centum	per cent
revolutions per minute	r. p. m.
second	sec.
specific gravity	sp. gr.
square	sq.
volume	Vol.
yard	yd.

CAUTIONS AND SUGGESTIONS

Do not pluralize abbreviations. Write *lb.*, not *lbs.*; *bbl.*, not *bbls.* The regular form of the abbreviation usually indicates either the plural or the singular.

Do not place *nd*, *st*, *rd*, *nth*, and so on after figures following the day of the month.

Do not use "&" for "and."

Do not use \times for *by* in connected discourse. For example, write, *16 by 20*, not *16 \times 20 feet*. The latter form may be used in tables of dimensions.

Do not use primes and seconds, ' and ", for feet and inches, except on drawings. In connected discourse, write "6 feet, 5 inches," or "6 ft., 5 in.," not "6' 5".

Do not use % in connected discourse. Write "interest is computed at 6 per cent.," not "at 6 %." The form % is used in tabular matter.

Avoid using the sign # for pounds, or as a substitute for "number" or "horsepower." This mark is useful to indicate "space" in proofreading, but its use should be limited to that purpose.

Examples of words which are preferably written out rather than abbreviated are *building*, *grain*, *gram*, *manufacturing*, *miles*, *rail-road*, and *ton*.

THE USE OF NUMERALS

In general, the same rule which limits the use of abbreviations may be applied to numerals. The expression of quantities in terms of figures suggests a matter-of-fact con-

text, similar to that in which abbreviations are permissible. The figures are not only more brief than words; they are also more easily understood. Within such a context, the only restriction to be imposed is that, whenever numerical expressions are plentiful, they should be grouped in tables instead of being scattered through the paragraphs.

As in the use of abbreviations, so in the use of numerals, the determining factor is the writer's purpose. In literary contexts, of course, figures are avoided entirely. If we are reading a story, we expect to find such a sentence as, "A stone's throw from the road stood an abandoned log cabin." Our imagination easily computes the distance as closely as is necessary for the purposes of fiction. If the expression is not too preposterous to imagine, let us suppose instead a sentence reading, "An abandoned log cabin stood 276 feet from the road." If we should encounter such a sentence, the spell of fiction would snap. We should find ourselves in the prosaic realm of exact measurements.

Many kinds of technical writing consist exclusively of appeals to our sense of fact. Consequently, they deal with exact quantities instead of approximations. The rules given below may therefore be consistently applied.

Figures are used to express dimensions, weights, distances, dates, degrees of angles or temperature, and other exact numerical data.

EXAMPLE:—The pump pit, which is cylindrical in shape, is 98 feet in diameter and 85 feet deep. It contains four triple-expansion Corliss engines, each weighing 2,800,000 pounds.

Enumerations. Note that enumerations, such as "four" in the phrase "four triple-expansion Corliss Engines," are expressed in words. The advantage of this distinction is seen in such expressions as the following:

One reason for the decrease in punctuation within the sentence is that modern practice favors a more simple and direct style than was formerly used. Other things being equal, the best sentences are considered to be those which require the smallest amount of punctuation to make them clear. In the interest of smooth-flowing language, the writer avoids constructions which trip the reader or cause him to stumble over punctuation marks. A statement like the following is condemned, not because it presents a difficult problem in punctuation, but because it is an example of poor sentence structure.

My prejudices, where scientific management is concerned, are, of course, many; though, in fairness to me,—to say nothing of those whom I represent—it should be said that, for the most part, these prejudices have been formed as a result of contacts with, and careful study of, actual cases.

Sentences which are selected to be used as exercises in punctuation are likely to be illustrations of bad style. Instead of being propped up with an elaborate falsework of punctuation marks they should be entirely reconstructed. The punctuation of the revised form would then be a comparatively simple matter.

Even sentences which are clear and direct in style frequently require a certain amount of punctuation to make their meaning unmistakable. Sometimes the necessity or the desirability of a punctuation mark is debatable, and the mark, if added, is a refinement of expression. It is a question of the effect which the writer wishes to produce. If a pause or an inflection at a given point will lend added expressiveness to his writing, then the insertion of a mark may be as important as the choice of a word or the turn of a phrase. At any rate, the reader has a right to assume that the marks are used for a definite purpose and to accept them as a guide to the writer's meaning. There are

many cases, of course, in which the writer has no option. Especially in practical writing, he must often choose a mark on the sole ground of intelligibility. The use or omission of a comma in a set of specifications, for example, may mean a difference of thousands of dollars to the parties interested. The courts are constantly called upon to interpret some one's meaning on the basis of his punctuation.

The feeling for punctuation. Punctuation begins with the conscious and deliberate application of rules or with the imitation of accepted models. Purely imitative punctuation should be avoided, because it may lead to the random and excessive use of punctuation marks. As we have seen, however, the marks are intended to serve a definite purpose. The burden of proof, therefore, rests on the one who uses them. Unless he can show good reason why a mark should be placed at a given point he should omit it. The reason is sometimes a matter of individual preference, but it may usually be given in terms of one of the accepted rules for punctuation. Although a certain amount of elasticity may occasionally be needed in interpreting these rules, they will generally be found to be a practical guide to usage and a sound basis for the formation of punctuating habits.

The process of applying the rules may be a slow and laborious one at first, for the writer's attention is divided between his thought and the mechanics of its expression. He will doubtless pause at many points to ask the reason for the rules and to test their validity by his own observation of usage. Gradually, however, he will acquire a philosophy of punctuation and a definite attitude toward cases which arise in his own practice. He will regard punctuation less as an arbitrary mechanical matter and more as an added instrument for the expression of his thought. Through intelligent repetitions, his application of the rules will become virtually automatic. The writer who has reached

this stage of direct and instinctive use of the proper mark may be said to have acquired a feeling for punctuation.

Rules for punctuation. The list given below includes only certain rules which are widely used in technical writing. Partly by reason of this restriction they will serve the better to guide the student and to form the basis of a working system of punctuation for his everyday use. The need for variety in punctuation is obviously less in technical than in literary writing, since the problem is one of stating facts and expressing logical, rather than emotional, relationships. The student will find some cases, however, in which the expression of a shade of emphasis calls for greater refinement of punctuation than is indicated by a set of simplified rules like those in the following list. He should therefore observe the practice of careful writers in order to derive or to test rules which are illustrated by their writings, and he should try especially to punctuate his own compositions in such a way as to give them added force and clearness.

The period. The period is used:

1. At the end of a sentence.
2. After an abbreviation.

The comma. The comma is used:

1. To separate the clauses of a compound sentence.

EXAMPLE:—These figures are only approximate, but they are sufficiently accurate to show the present tendency in wage systems.

The student can readily identify the compound sentences by the co-ordinating conjunctions, "and," "but," and "for." To avoid mistaking compound words or phrases for compound sentences, he should look for a change of subject, as in the foregoing example, in which a new clause begins with "they."

2. To set off transposed modifiers of the predicate.

EXAMPLES:

- a.* Because a satisfactory product cannot be obtained unless the temperature is kept uniform, the use of pyrometers has come to be regarded as necessary.
- b.* If the temperature is allowed to vary more than ten degrees from the normal standard, the finished product will be certain to be defective.
- c.* Usually, the temperature is not allowed to vary more than five degrees from the normal standard.
- d.* To keep the temperature uniform, pyrometers are regularly used.

The application of Rule No. 2 calls for a certain amount of elasticity. Sometimes the transposed modifier is short and is closely connected with the text which follows. Or perhaps there is a "phrase pause" which clearly marks the separation intended by the context and makes the comma unnecessary, as in the following sentence:

For this purpose the highest grade of steel is required.

On the other hand, if the transposed adverbial modifier is felt to deserve emphasis it should be set off by a comma, even though it may consist of a single word. In example *c.* the word "usually" is set apart for emphasis. The mere fact that an expression is shifted to the beginning of the sentence is an indication that the writer wishes it to receive special attention. He can strengthen the emphasis by adding a comma.

Sometimes the separation of a short adverbial modifier is made for the sake of clearness, as in example *d.* A transposed infinitive phrase denoting purpose is usually set off by a comma. The punctuation is especially needed in this sentence to keep the reader from coupling the words "uniform pyrometers."

3. To separate the members of a series.

EXAMPLE:—Screw-driver bits, self-feeding reamers, and tap drills have been ordered.

The student will observe that the comma is placed before the conjunction as well as between the preceding divisions of the series. If this particular sentence were not punctuated

in this way, the reader might assume at first that "self-feeding" modified the compound expression "reamers and tap drills," even though the "and" which follows the comma helps to make the meaning clear.

The principal reason for using the comma at this point in a series, of course, is to emphasize the equality of the different members which are meant to be regarded as co-ordinate. The fact that the punctuation is used for this purpose should be a sufficient answer to the fallacious assumption that "the 'and' takes the place of the comma." The conjunction joins two expressions; the punctuation mark separates them and emphasizes their individuality. The individual units of a series may be compound and may therefore include conjunctions within themselves. The student should remember that connectives and punctuation marks are not equivalent and interchangeable.³

4. To set off parenthetical expressions.

EXAMPLES:

- a. This method, however, is more expensive than the first.
- b. Your plan, if I am correctly informed, was submitted at the first meeting of the committee.

A parenthetical expression that occurs at the beginning of a sentence should be distinguished from a transposed adverbial modifier that is not used parenthetically. Such connective expressions, for example, as "on the contrary," "in the first place," "therefore," and "however" are nearly always set off by commas, whether they are used at the beginning of the sentence or are buried within it. Although they add something to the sentence, they are not necessary to its grammatical completeness. The non-parenthetical modifier, on the other hand, has close grammatical connection with its base. It represents an essential part of the main clause, and not merely an addition to it. The close relation between such a modi-

³ Not only the units of a series, but even a pair of co-ordinate elements which are joined by a conjunction may require the use of punctuation in order to emphasize their independence of one another. A case in point is the following sentence from Leigh Hunt's well-known poem, "Abou Ben Adhem": "*The angel wrote, and vanished.*" The comma shows that the two acts, although co-ordinate, are successive and distinct.

fier and its base may be observed in the following sentence:

In this way the parts of the machine are made readily accessible for cleaning.

Although a strict interpretation of the rule for transposed modifiers would require a comma after "way," the close connection makes this punctuation unnecessary and undesirable. The comma is not needed for the sake of either clearness or emphasis. Moreover, the light pause which naturally occurs at the end of the phrase is better suited to the expression of the writer's meaning than would be the distinct pause which is made after a parenthetical expression. It should be noted in passing that even a parenthetical expression may be given too light a touch to justify a comma, as in the following example:

The exceptions may therefore be omitted.

5. To set off a non-restrictive relative clause.

EXAMPLE:—This objection, which seems a valid one, is enough to warrant the defeat of the measure.

A non-restrictive, or explanatory, relative clause is really parenthetical in nature and so falls under Rule No. 4 as well. It is placed under a separate rule in order to call special attention to one of the most common mistakes in punctuation. An example of the restrictive clause is as follows:

The objection which (that) has been stated is a serious one.

This clause is closely connected with the antecedent, "objection," and depends immediately upon it; whereas, in the non-restrictive clause, there is no immediate or necessary grammatical dependence. The parenthetical nature of the clause may be tested by substituting an equivalent, though more remote, expression introduced by "and," for example:

This objection (*and it seems a valid one*) is enough to warrant the defeat of the measure.

6. To set off a non-restrictive participial phrase.

EXAMPLES:

a. The tool room, being centrally located, is the logical

clearing house for all pieces of equipment in regular use.

- b. The upper part, known as the "drag," is next placed in position.

It will be seen that this rule is fundamentally the same as Rule No. 5, since a participle is only a condensed clause, and the same principle applies to both forms. Likewise, the same test of close connection may be applied to distinguish a restrictive from a non-restrictive participle. The following sentence illustrates the use of the restrictive participle.

The cards used for this purpose are printed on heavy No. 1 stock.

The semicolon. The semicolon is used:

1. To set off independent clauses in a compound sentence.

EXAMPLE:—He was not simply negligent; he was guilty of criminal carelessness.

The two statements, it will be observed, are parallel but are not so closely connected as are those in the example under Rule No. 1 for the comma. The semicolon denotes a decided pause and a considerable degree of independence between the two assertions. It is thus a sort of magnified comma.

2. To separate long or subdivided units in a series.

EXAMPLE:—This machine is superior to the older model because of three outstanding improvements: a complete automatic oiling system, *which insures uniform and continuous lubrication*; a cam feed, *which replaces the less convenient ratchet feed for traversing the table*; and an internal transmission unit, *which does away with cone pulleys and gear boxes*.

The semicolon is particularly needed when the members of the series are subdivided by commas. For the sake of emphasis, however, the semicolon may also be used with short and simple expressions. The foregoing example without the subordinate clauses may thus be written with either commas or semicolons between the units of the series.

The colon. The colon is used:

1. To introduce a long quotation or an enumeration.

EXAMPLES:

- a. The chairman said:
- b. The following apparatus was used:

2. To introduce a formal letter.

EXAMPLE:—Dear Sir:

The hyphen. The hyphen is used:

1. To divide a word at the end of a line.

EXAMPLE:—The question to be settled at this time is important.

2. To join the parts of fractions and of certain compound words.

EXAMPLES:

- a. Twenty-seven 4-inch pipes.
- b. A variable-speed motor.
- c. One and two-thirds kilowatt-hours.

For a fuller discussion of the use of the hyphen in compound words, see pages 41–50. The principles governing the use of the hyphen are summarized on page 42.

3. To separate a prefix which would be awkward if written as part of a single word.

EXAMPLES:

- a. Two consonants, as
non-nitrogenous (separate pronunciation of n's)
sub-bituminous
- b. Two vowels, as
co-operative (also written coöperative)
pre-ignition

Words coined by the addition of *re*, *over*, *under*, *sub*, *non*, *self*, *semi*, and other prefixes usually take the hyphen. Sometimes the unfamiliarity of the combination is considered a sufficient reason for separating the prefix with a hyphen. A word like “non-typical” might be written with the hyphen for this reason. On the other hand, words like “electroplate,” “electrotype,” and other compounds with “electro” have be-

come so common that the hyphen is not felt to be needed. Familiarity or unfamiliarity depends so much upon the personal equation, however, that it is safer to follow precedent than to try to apply the foregoing rule.

SPELLING

Mistakes in spelling are often felt to be pardonable, if not unavoidable. However, the fact that many people spell badly does not give any one a sufficient excuse for neglecting his orthography. English spelling, to be sure, is difficult. It is not phonetic, nor is it logically consistent; but, though its irregularity may be deplored, the language must be accepted and learned as it is. Moreover, it *can* be learned. The popular notion that people are born good or bad spellers should be distrusted, like every other effort to substitute a law of heredity for individual responsibility. No one should despair of becoming a good speller—certainly not until after he has discovered the chief causes of his own bad spelling and has made a sincere effort to remedy them. In removing these causes, he will incidentally rid himself of some graver forms of inaccuracy, of which bad spelling is symptomatic.

It is the purpose of the following discussion to suggest a few of the ways in which any one can diagnose his own case and improve his spelling. The student should supplement what is given here by further study of the rules for spelling; by revision of his own manuscripts, together with drill in the misspelled words found therein; and finally, by constant attention to the *form*, the *pronunciation*, and the *meaning* of words.

Observation. Inaccuracy of observation is responsible for many mistakes in spelling. To test this statement, copy a page of text, and then check up the words which you have inaccurately transcribed. Notes from printed sources abound in misspelled words which were not observed

carefully in the first place. In the case of many words,—proper nouns, especially,—the eye alone must be relied upon for correctness in spelling. Test this statement by writing, after a glance at them, such words as “shrapnel,” “perspiration,” “laminations,” “reservoir,” “California,” “Alabama,” “Macaulay,” “Defoe,” “Meredith,” and “Allis-Chalmers.” To remember that words like “switchboard” and “framework” are written without hyphen or break, is also chiefly an act of visual memory.

Pronunciation. If the observation of a word is clear and the pronunciation is correspondingly distinct, the two processes will reciprocally strengthen each other. If we actually say “incidentally” instead of “incidently,” “laboratory” instead of “labratory,” or “Niagara” instead of “Niagra,” we go far to insure accuracy in spelling them. If, on the other hand, our pronunciation is careless and indistinct, we cannot expect our writing to be correct in form.

Definition. It would seem a safe assumption that whoever has occasion to spell a word must have no doubt as to its meaning. In point of fact, however, as many words are wrongly used as are misspelled. Sometimes the misused word is the correct spelling of a word that differs from it in meaning but is similar, if not identical, in sound. Thus, words like “principal” and “principle,” “stationary” and “stationery,” “populous” and “populace,” “cite,” “site,” and “sight,” and many other pairs and groups of words require discrimination in meaning before correct spelling is possible. What is spelled is not so much a sound as a shade of meaning. In such cases, to plead constitutional inability to spell is no defense. The writer is doubly guilty, for his fault includes both spelling and definition.

It is evident that observation, pronunciation, and definition are closely associated, and that they work together to prevent errors in spelling. Pronunciation and definition

should serve as a double check on observation. Thus, if the eye should mistake "casual" for "causal," the difference in sound should arrest one's attention, and the complete dissimilarity in meaning should show unmistakably which word the writer intended to use. In composing, as distinguished from copying or revising, the meaning comes first, and correctness of form should follow as a matter of course.

Rules for spelling. Notwithstanding the inconsistency already mentioned as characteristic of English spelling, there are some groups of words the spelling of which is sufficiently uniform to warrant the derivation of rules. Contrary to the general belief, these rules are comparatively easy of application, especially when they are remembered in terms of examples. A few of the principal rules for spelling are given below. For a more complete list the student is referred to the dictionary or to any of the various handbooks of composition.

a. A monosyllable, or a longer word accented on the last syllable, if it ends in one consonant preceded by one vowel, doubles the final consonant when a suffix beginning with a vowel is added. Examples are *stop*, *plan*, *set*, *fit*, *tap*, all used as verbs and written *stopped*, *planned*, and so on, for the past tense. Note the influence of the accent on the spelling of two groups of longer words represented by *transfer* and *benefit*, respectively.

b. Silent final *e* is usually dropped when a suffix beginning with a vowel is added. Examples: *line*, *shape*, *guide*, *live*. Exceptions to this rule occur when *e* is needed to preserve the pronunciation or the identity of the word; e. g., *singeing*, *changeable*.

c. Nouns ending in *y* preceded by a consonant change *y* to *i* in forming the plural; e. g., *cry*—*cries*. (But the plural of *chimney* is *chimneys*, since *y* is preceded by a vowel.)

d. Verbs ending in *y* preceded by a consonant change *y* to *i* in forming the present third singular and the past; e. g., *carry*—*carries*—*carried*.

e. The old rhyme, "i before e except after c" is helpful in the case of the troublesome *ie* and *ei* words. There are, however, a few exceptions, such as *sheik*, *weird*, *weir*.

For convenience, the foregoing discussion of spelling may be summed up in these suggestions:

Observe closely. See to it that the form of a word is definitely fixed in your mind.

Pronounce each word distinctly. Look up every doubtful word, and repeat the correct pronunciation until you are sure of it.

Learn the definitions of words, and practice associating meaning with form.

Become so familiar with the rules for spelling, as illustrated by typical examples, that you are rapid and certain in their application.

Keep a complete list of words that you have misspelled, and drill yourself frequently on their correct spellings.

Every student should have sufficient interest in the improvement of his own spelling to apply these suggestions regularly in his written work. The importance of such improvement can hardly be overemphasized. With the possible exception of bad grammar, of the "ain't" variety, nothing so readily suggests illiteracy as bad spelling. A writer's friends may make allowances, but strangers who know him only through the written word will judge him largely on the basis of his orthography. Worse still, they may classify him, intellectually or socially, on the same basis. The mother of Arthur Pendennis was justifiably alarmed over her son's attachment for a young woman who spelled affection with one "f." Prospective employers have felt equally doubtful of applicants who misspelled "efficiency."

Below is given a list of one hundred words that have most frequently been misspelled in the manuscripts of a group of technical students. Write these words down at the instructor's dictation, then check your list with the words as printed. Compute your percentage by deducting

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one point for each word that you have misspelled. The instructor, upon re-checking your list, may then deduct two additional points for each word that you have overlooked. The re-checking process will be a test of your visual accuracy.

accessible	eliminate	parallel
accommodate	equipped	per cent
accurate	exhaust	personnel
affect (effect)	facilitate	piece
alignment	filtration	phosphorus
aluminum	foundry	planning
analysis	gage	preceding
applied	(gauge)	precipitate
article	gases	preventive
automatically	governor	principal
auxiliary	gravitation	(principle)
business	guard	procedure
caisson	height	propeller
capacity	horizontal	quantity
chute	hydraulic	receptacle
column	ignition	recommend
compressor	indispensable	referred
condenser	inflammable	remedy
control	insoluble	reservoir
controlled	insulation	resources
conveyor	interchangeable	riveted
coarse (course)	laboratory	scraper
cupola	laid	sediment
cylinder	liquefy	superintendent
definite	lose	temporary
description	maintenance	tendency
desirable	making	too (to)
detached	malleable	transmission
dimensions	manufacture	triple
disappear	mathematics	trolley
disintegrate	movable	until
distillation	necessary	vacuum
eccentric	operation	ventilate
efficiency	original	vertical

The foregoing list of words illustrates a principle which the student may well apply in an effort to improve his own spelling. These words were almost the only ones that gave serious trouble to the group of students from whose manuscripts they were compiled. Most persons find that their mistakes in spelling are confined to a comparatively small number of words, which they repeatedly misspell. Each individual's list is different from every one else's, but each list is short enough to be mastered in a brief period of intensive drill.

THE WRITING OF COMPOUND TECHNICAL TERMS

Perhaps the most distinctive feature of the technical vocabulary is its large proportion of compound words. To be sure, one does not encounter in every line such striking examples of compounding as "*a three-step-cone, double-back-gear, two-counter-shaft-speed, screw-cutting lathe*"; but similar agglomerations are by no means rare, and because of the growing complexity of machines and processes, their number is rapidly increasing. Shorter compounds are so common in technical writing that they might pass unnoticed, were it not for one thing: the perpetual uncertainty as to how they shall be written.

One's first impression, on reading a page of engineering discussion, is that there is no law or custom governing the writing of compound technical words. Even the most familiar compounds, such as "switchboard," "waterproof," "blueprint," and "crankshaft," are written in two or three ways. Moreover, instances are not wanting in which two or three forms of the same compound are used in the same issue of a given magazine, and even in different parts of a single article. For those who prefer to write consistently, and at the same time with the sanction of usage, this dis-

parity of precedents is hopelessly bewildering. Some time ago a class in English investigated the practice of some twenty representative technical journals in the hope of discovering certain general principles which would be helpful in the writing of compounds.

In this investigation it was noted that a fairly large proportion of individual journals showed sufficient uniformity in the writing of such words to indicate an effort at standardization, perhaps through a carefully prepared style sheet, or a competent "style man." Moreover, a comparison of the various journals showed a tendency toward uniformity throughout the group. Consciously or unconsciously, it seemed, certain principles were being followed which might be made more useful by being formulated.

Rules for writing compound words. On the basis of the data which were collected, the practice of American technical journals with reference to the writing of compound words may be briefly stated as follows:

1. *Write compound nouns without the hyphen;*⁴ that is, either as two words in the case of separable, or loose, compounds (*cast iron*, *friction clutch*, etc.), or as one word in the case of inseparable, or close, compounds (*roadway*, *falsework*, etc.).

2. *Write adjective compounds with the hyphen;* e. g., "*four-cylinder automobile*," "*cast-iron frame*," "*low-pressure system*," etc.

The second rule is subject to some exceptions, including close, or inseparable, compounds, e. g., "*overshot wheel*," "*fireproof building*," "*waterproof lining*," etc. Most of the exceptions fall under a general rule, which may be stated as follows:

3. *Omit the hyphen wherever the meaning is clear without it;* e. g., "*power plant economy*," "*machine tool design*," etc. This rule is made, of course, in the interest of further simplification. It includes Rule No. 1, and is a corrective for Rule No. 2. Obviously, the easier plan would be to follow the second rule con-

⁴ A few exceptions are found in such special forms as "set-up," "ton-miles," "foot-pounds," and "kilowatt-hours" and in phrase compounds like "right-of-way." Such cases, however, are rare and are easily identified.

sistently, regardless of the number of hyphens which clogged the text. The adoption of Rule No. 3 results in a cleaner text, but it necessitates writing with greater discrimination, since the writer must decide where the hyphen is needed for clearness and where it may safely be omitted. No difficulty is likely to be experienced in the case of such expressions as "*machine shop* methods," but an expression like "*cold-rolled* steel" should be written with the hyphen regardless of the context. Those who cannot easily distinguish the relative clearness of such compounds written with and without the hyphen will do well to avoid attempting to use Rule No. 3.

In the various magazines examined there were, of course, some exceptions to these rules, and there were also differences in the extent to which the rules were followed. Although some of the exceptions are not without apparent validity, they are omitted in order not to obscure the main issues. As we have noted, the rules represent rather the general tendency of usage than the deliberate and consistent practice of technical writers. This agreement in general tendency, however, is significant, for it indicates what will probably become the settled tradition in technical journals. Although the rules embodying the practice are stated in terms of the hyphen, it is evident that the hyphen itself is purely secondary, and that the rules have weight only in so far as they rest upon a sound theoretical basis. Before judgment is passed on the rules, therefore, the theory of compound words should be briefly reviewed.

The theory of compound words. A compound word is formed by the union of two or more words in a special sense other than that conveyed by a simple grammatical relationship. Just as a mathematical quantity enclosed in parenthesis is regarded in its entirety, so a compound word is considered as a whole, rather than as a succession of separate parts. We may of course recognize the parts, but the test of a compound is whether the expression as a whole

constitutes a single word. Within the compound, the first part usually limits or qualifies the second part, and hence receives the stronger accent. Thus, in "gas producer" and "producer gas," the descriptive part of the compound word comes first and is accented in order to distinguish the kind of producer or gas. The importance of accent in compound words, as will be more fully explained later, is twofold, in that it not only aids in identifying the expression as a compound but also indicates the extent to which the parts are unified.

Loose, or separable, compound nouns. Compound words vary widely in the closeness of the relationship between their parts. In the case of compound nouns, for example, we have at one extreme the loosely connected pair of words only one step removed from being a simple word and its modifier. Such words as "motor truck," "drill press," and "machine tool" clearly unite to express a single idea, but they are not felt to be inseparable. Each retains its identity and a certain degree of its original accent. In such cases the preference of most technical writers is for the omission of the hyphen. (Rule No. 1.) Several reasons may be assigned for this preference. The comparative independence of the words is recognized, the meaning is made sufficiently clear by juxtaposition, the text looks cleaner without the hyphen, and the problem of writing is simplified if the compound is put in the form of two words. Or perhaps we may say that the hyphen is taken for granted; an invisible hyphen, as it were, connects the parts of the compound. Some engineers insist that these compounds, being technical, and being written almost wholly for technical men, need not be labeled in order to be understood. One engineer gives this as his reason for wishing to abolish the hyphen altogether. Whether we are willing to go so far or not, we must admit the validity of the argument that

technical men have a right to be consulted as to the form of their own vocabulary. At any rate, compound nouns are not likely to be misunderstood by the technical men who use them. The following list contains a few examples of the large class of compound nouns which in most technical journals are written as two words:

air chamber	dry dock	peak load
air compressor	dust guard	pig iron
air duct	end thrust	pipe tongs
air pump	engine room	pipe wrench
angle iron	escapement wheel	plug switch
arc lamp	feed water	power plant
armor plate	flash point	press fit
balance wheel	flat car	pressure gage
ball bearing	flow sheet	pump shaft
belt wheel	force pump	push button
blast furnace	freezing point	road roller
boiler room	friction clutch	rocker arm
bolt head	gas engine	safety valve
box car	gas producer	sheet iron
cast iron	gate valve	slide rule
circuit breaker	generator room	smoke flue
coal dust	lamp cord	steam chest
coal field	locomotive engineer	store room
coal tar	machine shop	stuffing box
cold chisel	machine tool	surface elevation
connecting rod	motor car	toggle joint
cylinder head	motor truck	train shed
dead center	mud drum	turret lathe
direct current	oil cup	twist drill
double track	oil groove	valve gear
drafting board	oil pan	water gage
drawing board	oil well	water tank
drill press	packing ring	wrought iron

It would be easy enough for the captious critic to place a strained interpretation on many of these pairs of words. Every one is familiar with the type of person who, with an

air of great subtlety, would point out that "rolling mill" without the hyphen might mean a mill which is constantly describing a rotary motion. This kind of critic is only a harmless Dundreary, who, lacking the restraining influence of a sense of proportion, delights in discovering all manner of absurd ambiguities. We know, for example, how Dundreary at his worst would soliloquize over an everyday expression such as "vacuum cleaner." "Why should anybody want to clean a vacuum?" And then, in a burst of triumphant reasoning, "What could he possibly find to clean, in a vacuum? What a perfectly superfluous invention!" It is perhaps not putting it too strongly to say that many objections to the separation of compound technical terms would belong in this class. They would be far-fetched, and would differ in degree rather than in kind from the exaggerated perversions of a Dundreary.

Close, or inseparable, compound nouns. At the opposite extreme from the separable compounds is a class of compound nouns which, because of close connection and long association, are written solid. In these words the literal meaning of the separate parts has become obscured or forgotten, and the result is a single word that has become completely unified. "Foreman," for example, is felt to be as closely unified as the simple word "boss," or as the derivative word, "superintendent." The tendency toward close unification is strong in compound words which are much used, particularly if they are spoken, rather than written. To the eye, a term like "forecastle," though closely unified, shows its original make-up, but the spoken word has become something like "focsl," showing the sailor's recognition of its unity and his disregard of its elements. Other examples of nautical terms which will readily suggest themselves are "bosn" for "boatswain," and the remarkable condensation "fotogansl," which is scarcely recognizable as "foretop-

gallant-sail." What takes place in these oft-used compounds is true to a lesser degree in the familiar compound words of other associations. Usually, the strong accent given to the first part of the word—an involuntary testimony to the extent of its unity—aids one in deciding whether a compound word has gained its right to be written solid. Though the practice varies somewhat, the following words are representative of a fairly large class of compound nouns which are preferably written solid.

airplane	crankshaft	intake	sandpaper
airship	cribwork	jackshaft	sawmill
ashpit	crosshead	keyseat	smokestack
backfire	crowbar	keyway	spillway
battleship	cutoff	landmark	standpipe
bedplate	dragline	lookout	stockholder
bedrock	drawbar	manhole	switchboard
blueprint	engineman	network	tailrace
brakeshoe	falsework	offset	tailstock
brasswork	firebox	orebody	tidewater
breakdown	fireclay	overflow	turntable
bucketful	flashlight	overload	underframe
bulkhead	flywheel	output	voltmeter
busbar	foreman	payroll	washout
camshaft	framework	penstock	watershed
candlepower	gangway	railroad	waterwheel
capscrew	guncotton	rainfall	wattmeter
carload	handbook	roadbed	wheelbase
clamshell	horsepower	roadway	woodwork
countershaft	hotwell	roundhouse	workmen
crankpin	input	runway	wristplate

In some discussions of compound words, an effort is made to distinguish an intermediate degree of intimacy between the separable and the inseparable compounds, and the hyphen is used to mark the middle shade of relationship. This distinction offers many excellent opportunities for argument, but there is little evidence to show that technical

writers in general pay any serious heed to it. On the whole, they are probably justified in disregarding a difference which is so hard to determine and which has so little practical value. By distinguishing broadly between only two classes, the separable and the inseparable compounds, they at least reduce the area of debatable ground.

Compound adjectives. The use of the hyphen in compound adjectives is more common than its omission in compound nouns. There is a grammatical principle which, whether stated or not, doubtless accounts for the joining of adjective compounds. In expressions like "cast-iron frame," or "crude-oil engine," for example, if some arbitrary sign were not used to show that the two words as a unit modify the noun, the natural inference would be that they were successive adjective modifiers. Thus, "a cast iron frame" might indicate that the frame was cast in one piece, and a "crude oil engine" might mean a crudely designed engine in which oil was used as fuel. These distinctions, it will be observed, mean more than the Dundreary quibbles mentioned in the discussion of separable compound nouns. As a matter of fact, the compound adjective consists of a modified modifier. First, the base of the compound is limited by the descriptive part; then, in its modified form, it describes a noun. In the expression "low-water mark," for example, "water" is modified within the compound, and the new word thus formed modifies "mark." In the discussion on page 43 too strong a case was probably made for Rule No. 3. Although, in many adjective compounds such as those cited under Rule No. 3, the meaning could hardly be mistaken if the expression were written as two words, nevertheless, there is much to be said for the practice of using the hyphen regularly between the parts of the compound adjective. (Rule No. 2.) The hyphen merely emphasizes the intended construction. In addition to this

advantage one finds some satisfaction in being able to use the hyphen consistently.

The examples given below are chosen to illustrate the principal ways in which adjective compounds are formed.

Noun + Noun Compounds

tool-room (practice)	motor-generator (set)
machine-tool (operation)	railway-accident (problem)

N numeral + Noun Compounds

two-cycle	three-ply
four-inch (4-inch)	2200-volt
six-cylinder	16-candlepower
40-horsepower	third-class

Descriptive Adjective + Noun

high-speed (engine)	high-potential (insulator)
open-hearth (process)	cast-iron (frame)
heavy-duty (engine)	high-pressure (system)

Compound Participial Adjectives

wedge-shaped	cold-rolled
nickel-plated	water-jacketed
motor-driven	high-priced
shunt-wound	wood-working (machinery)
direct-connected	wire-drawing (machine)
home-made	cost-keeping (methods)

Phrase Compounds

drop-of-potential (method)	make-and-break (ignition)
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Expressions like the foregoing are regularly written with the hyphen.

To revert to the three rules, we need not advocate their unqualified adoption, nor suggest definite limits within which they should be applied. They have been brought together primarily as a statement of what a more or less informal

investigation indicates to be the chief tendencies in this regard among technical writers. The rules are safe and practical guides to usage, and they do not seriously offend against the theory of compound words. It is hardly likely that such rules could ever be generally adopted outside of technical contexts, but where there is much repetition of certain compounds, and a limited reading public to whom the expressions are familiar as technical terms, writers may well agree upon some such conventional practice as the rules represent.

CHAPTER III

LOGICAL ORGANIZATION OF MATERIAL

ANY one who expects to write on a subject must first do some thinking about it. The result of his thought is usually an outline, which indicates his purpose and shows the division of his material. Under different conditions the outline may vary widely in external form and in complexity. It may range from a simple twofold classification to an elaborate, minutely subdivided brief, covering several pages. In some cases it may not be written at all, but may exist solely as a mental plan, which the writer is able to follow readily because of his previous concentration of thought on the subject. In its origin, at least, every outline is a problem in the analysis of material. The outward form is only a convenient mechanical device to indicate how the writer has organized his subject matter.

The outline not only aids the writer in clarifying his own thought; it assists the reader in understanding the purpose and meaning of the finished composition. If the writer has made a thorough analysis, the reader can follow the discussion more easily and can remember it better. What is chiefly remembered, in fact, is the outline. The details relate themselves naturally to the main divisions of the writer's classification. If these divisions have been clearly presented, the reader can easily reconstruct the subordinate parts of the outline.

A striking example of the way in which the writer's preliminary analysis aids the reader in understanding the subject is found in the experience of a large industrial

institution. Having completed an architecturally beautiful group of factory buildings, with landscaping to correspond, the firm wished to interest the entire community in landscape gardening. To this end, they engaged a prominent landscape architect to prepare a popular discussion of the subject. This was partly a problem in the adapting of language, but it was basically a problem in analysis. The architect reduced the theory of landscape gardening to three simple rules:

Plant in masses
Leave open space
Avoid straight lines

The author of this discussion went to the heart of the subject and picked out its essentials. In this way he made it easy for any one to remember the details in their proper relationships. For example, if it was pointed out that nature propagates plants in clusters because new life springs from the roots, or because the seeds fall thickest near the parent stock, such suggestions could be recognized immediately as belonging under the first of the three principles. Likewise, a reference to nature's disapproval of formal gardens would relate itself at once to the third division. Both the reader's notes and his own observations on the lecture would easily follow the main outline.

In making his preliminary analysis, the writer must literally think his way into the center of the subject. If, instead, he begins by merely making an outline, he may create something that looks impressive at first glance, but upon close examination is found to be vague, meaningless, or possibly ridiculous. One way in which the student can demonstrate this fact convincingly is to try constructing an outline on a subject that he knows nothing about. For many persons, a good subject would be "The Einstein

Theory of Relativity.” Almost any one can put down some headings that look imposing and are safe, such as:

- A. Statement of the Theory
- B. Applications of the Theory
- C. Criticisms of the Theory

Note, however, that these are general and evasive topics. They merely postpone the evil moment in which the writer must confess his ignorance. Unless they are made specific or are followed by subheadings which express definite ideas, they are worthless. The writer is in trouble the moment he is called upon to say just what are the applications or the criticisms at which he has hinted in his outline.

The kind of outline needed varies, of course, with the subject and with the writer's purpose. In its simplest form it may be nothing more than a series of loosely associated topics which are brought together for convenience. Suppose, for example, that a student is about to prepare a paper on the perennially appropriate subject, “Recent Improvements in Automobile Design.” The divisions of his outline will evidently be associated, rather than closely related. His composition will grow by accretion instead of organically, from within outward. Similarly, in a set of specifications, the headings may represent a number of wholly independent items which happen to relate to the same thing, such as “Hardware,” “Excavation,” “Plumbing,” and “Masonry.” In such an outline the units are not closely connected, nor are they arranged in any necessary order. Some principle of sequence, however, is nearly always followed, even if it is only an alphabetical or a numerical one.

Sequence. The arrangement of topics in an outline frequently follows a chronological order, as “Excavation,” “Masonry,” and so on, corresponding to the successive stages of building construction. Any composition which includes

the history of a subject necessarily follows a chronological scheme in the arrangement of its general outline, such as

Origin
Development
Present Status

This is also the formula for the so-called "evolutionary" method of treating a subject. Often the most effective way of explaining a machine, a process, or a movement, is to trace it from its crude beginnings to its advanced stage of development.

The outline for a description of a factory, for example, may indicate the steps in a manufacturing process, beginning with the raw material and ending with the finished product. The various parts of the factory would usually be visited in this same order; but whether this were done or not, the obvious plan for the description would be to trace the stages of manufacture in the order of their occurrence. The following "contents" outline for an inspection-trip report on a visit to a paper mill illustrates a logical handling of sequence and subordination:

The General Plan
Principal Products
Location and Layout

The Power Plant
The Coal Supply
The Engine Room

The Paper Mill
Sources of Pulp
The Beater Engines
The Cylinder-Board Machine
The Drying Section
The Finishing End

The Laboratory
Tests of Raw Materials
Control of Processes

This first section might be labeled "Introduction," since its purpose is to indicate the subject matter of the report as a whole. Usually, a brief report begins directly with one to three paragraphs and contains no headings or subheadings.

The main heading, "The Power Plant," leads into the detailed part, or "Body," of the report. From here on, the paragraphs are longer. The treatment is not summarizing but descriptive. Specific facts and explanations are included. Drawings and photographs are often used in this part of the report.

Within the division headed "The Paper Mill" there is a problem of organization exactly similar to the outlining of a long composition. Note that the sequence is determined by the order in which the raw material passes through the various manufacturing units.

The section on "The Laboratory" rounds out the description of the factory as a whole, though it is not a "Conclusion" in the formal sense of the term. An artificial, summarizing "Conclusion" is seldom used in this type of report.

In technical writing more than in any other kind are found those ready-made outlines in which the writer has only to follow the steps originally taken by the engineer who laid out the plant or devised the process which is to be described. In such a case it can truthfully be said that the subject "naturally divides itself" into certain branches.

In general, however, a subject does not "naturally" divide itself, but must wait for some one to divide it. Suppose that we are given the general subject, "Pavements," on which to write a discussion. In the process of getting our ideas together we probably put down a number of topics, for example:

Concrete
Asphalt
Brick
Wood Block

We discover that in our selection of these headings we have been guided, perhaps subconsciously, by the general idea of "paving materials." We can then decide whether we shall restrict our discussion to this phase of the subject. We may make "Paving Materials" a main heading within a more comprehensive treatment of the larger theme, or we may deal with a special phase, such as "Methods for the Rapid Repair of Pavements." We must of course adopt a specific subject as a basis of classification.

In one respect the foregoing is not a typical case. We do not ordinarily allow our minds to play about a subject in the hope of arriving at an acceptable basis for an outline. If we do, the chances are that our composition will not be worth reading. If our aim is merely to construct an outline, we may experiment with numerous topics. When we plan to write, it is different. We begin, or should begin, with a definite purpose, which determines the direction of our thought and the basis of our classification. For ex-

It will be seen that there is a general principle of classification that is common to all the members of the series. In other words, Ruskin has thought his way into the center of the subject and has arrived at a fundamental basis of classification.

2. *The divisions of a classification should all be of the same rank and kind.*

The test of the various units in Ruskin's outline on buildings, is that they shall agree in their relationship to the basis, or the central principle, of classification. For one thing, this means that they must all have the same grammatical form. More important still is the requirement that they shall not overlap, and that each shall represent, like the others, a purpose for which buildings may be designed, since *purpose* is the basis of Ruskin's classification. Suppose, for example, that the list were revised to read, "Devotional, Memorial, Gothic, Tudor, Colonial, Domestic," and so on. The headings which denote styles of architecture instead of purpose would violate Rule No. 2. They might be useful in some other outline, or in the subdivisions of this one, but they do not parallel the main headings.

3. *The divisions of the classification should all be included.*

Suppose that, in discussing self-propelled vehicles, a writer divides them into two main classes, gasoline-propelled and steam-propelled vehicles. The basis of his classification is evidently *motive power*. Judged by this basis, his outline is evidently incomplete, since he has omitted electrically propelled vehicles, an important class belonging to the same rank as the other two kinds.

It may be noted in passing that a great deal of humor is derived from incomplete classifications. Charles Lamb, in his essay, *The Two Races of Men*, divides all mankind into two classes: those who borrow, and those who lend.

The borrowers are described as a light-hearted, companionable group and the lenders as a sober, tight-fisted, suspicious race. Lamb's classification, of course, ignores two other possible groups; those who neither borrow nor lend, and those who both borrow and lend. To get a stimulating presentation of a half-truth in the form of an incomplete classification, the student should read *Are You a Bromide?* by Gelett Burgess.

Ruskin's classification of buildings may also be tested by Rule No. 3. Especially from the standpoint of the various purposes for which buildings of architectural distinction are now designed, it may well be asked whether Ruskin's list of headings is complete. If an important kind of building can be mentioned which does not fall under any of Ruskin's five classes, a new division is needed.

The divisions of every outline should be made to conform to the foregoing rules. As a measure of logical consistency and validity, the rules are equally useful in testing the subdivisions under each main division of the general subject. For example, there may be several distinct types of devotional architecture or of any other branch of Ruskin's classification. Since the writer need deal with only one set of units at a time, there is no reason why his outline, however minutely its parts may be subdivided, should present an impossibly difficult problem in the organization of material.

Useful and important as they are, the foregoing rules for logical division should not be followed literally by the writer during the thinking process. The rules are intended chiefly as a test of his results. While he is thinking his way through a subject the writer should exercise a maximum of freedom in arranging and phrasing the units of his classification and should not be hampered by undue consciousness of rules or of outline forms. If his consideration of the

subject is thorough, there will be little question about the clearness of his outline.

An illustration of the way in which the results of a writer's analysis are incorporated into a finished composition is found in the following passage, which is quoted from an address by John Mills, Personnel Director of the Bell Telephone Laboratories, Inc., on the subject, "Selecting and Placing College Graduates in Business." Mr. Mills was speaking at an annual convention of the American Management Association.

EXAMPLE OF CLASSIFICATION DERIVED FROM ANALYSIS

After we have answered these intermediate questions we shall probably agree that we turn to the colleges in the hope of obtaining men of good mental ability and personality, who have acquired habits of thought and study which will enable them to see broadly the business and technical problems of the future, to analyze the factors involved, to arrive objectively and without prejudice at solutions, and through personality and executive ability to give those solutions weight and effectiveness. We look, I believe, for trained brains, in vigorous bodies, with pleasant but dynamic personalities, men who may make creative contributions to our respective businesses or arts, and in a sufficient number of cases develop as capable executives.

If this is what we are looking for in employing the college man, if we want the man who can think straight and in advance of the majority and can prove or substantiate his conclusions, whether or not he remains an individual contributor or acquires some executive position, then, I believe, we are in a position to write tentative specifications for such a man.

You will notice that I believe in writing specifications for the man, and not specifications for the job. I am entirely willing that for the more routine, repetitive, and standardized tasks of industry, job specifications shall be written, but when it comes to employing in the hope of obtaining the future creative genius or far-seeing executive, I believe we must work to man specifications. Let me, therefore, state what I conceive to be the main specifications which

are applicable in the employment of college men for any industry which offers real opportunities for human development. The specifications are six in number.

Specifications for the Employment of College Men

The first is that of *intellectual curiosity*. Unquenched and unquenchable intellectual curiosity is, to my mind, the first requisite for growth in our rapidly progressing age. Under this term I do not include the casual and idle curiosity of the feeble and twittering mind. I mean that sort of curiosity which leads to a continued and orderly effort to determine the why of the physical or social phenomena of the world about one. It is a motive or urge which, coupled with the instinct of workmanship or creation, distinguishing primitive man from his brute associates, has been responsible, I believe, for most that is desirable in either the spiritual or the physical side of our civilization.

The second requirement is *the ability to study*. It is perhaps the one real aim in education; but the percentage of the population which has the ability to study is much less than the percentage of academic degrees or similar evidences of learning would appear to indicate. Learning looks to the past, while study looks to the future. In the first meanings given by the familiar authority of Webster, "learning" is "gaining knowledge, understanding, or skill," while "studying" represents "applying the mind" and acquiring knowledge "by one's own efforts." It is this ability to apply one's mind and acquire knowledge by one's own efforts which the college man that we want in industry must have acquired.

The third requirement is *the habit of study*. Apparently this is a habit which takes time to acquire, and the four years of a college course have frequently proved insufficient time.

The three remaining specifications have to do with the student's attitude and abilities in human relationships. The fourth requirement in our specifications is, therefore, *the ability to learn from men*. The fifth is *the ability to co-operate with men*; and the sixth, *the promise of ability to lead and influence men*. I place these last three requirements in the specifications in this order, because I feel that the ability to learn from men is the most important, and, if inherent in an applicant for employment, must in time lead to an ability to co-operate with men and a basis for trust and confi-

dence which will provide opportunities for leadership. These are the man specifications which I think business and technical industries should try to satisfy in hiring the product of our colleges. With them I trust you are in essential agreement.

Looking back over the analysis made by Mr. Mills, we note that he starts with a definite purpose and a clearly perceived basis of classification. He chooses to write specifications for the man instead of specifications for the job. On the basis selected, he then presents a succession of requirements which, when arranged as a list of topics, constitute a complete outline, as follows:

Specifications for the Man:

Intellectual curiosity

The ability to study

The habit of study

The ability to learn from men

The ability to co-operate with men

The ability to lead men

If we wished to make a further classification of these topics, we could follow the author's suggestion and group the first three and the last three under two different headings. They are all on a par with reference to the basis, "Specifications for the Man"; but since three of them deal with intellectual qualities and three with personal characteristics, an expanded treatment of the subject would probably recognize these two subdivisions. Even in his brief summary, Mr. Mills has provided the groundwork for a separate discussion of an employee's relations with ideas and of his relations with men.

A final example will show how a classification may be developed and applied. Just as the analysis has been made originally from the observation of particular facts, it is explained, for the reader's benefit, in terms of specific illustrations. The following "Analysis of Work" shows how a classification is first derived and then applied:

EXAMPLE OF CLASSIFICATION DEVELOPED AND APPLIED

Now of all the products of the labor of the centuries, there are probably none to which we of this generation look with more satisfaction than to our scientific achievement and our mechanical ingenuity. And yet these two distinguishing elements of our modern civilization have set up barriers to the realization, by the majority of workers, of the greatest benefit of work, namely mental development; for they have wrought significant changes in the conditions of work.

In the first place, it is only within the past two generations that mankind has worked in masses within walls. For centuries men did individual, self-directed work almost entirely in the open. The change has come, of course, through the development of power devices, and dates virtually from the invention of the steam engine.

In the second place, the industrial worker formerly knew a whole job, rather than a part of it; he performed a great variety of functions in the completion of his task, instead of endlessly repeating the same limited operation. The clockmaker made a whole clock, working individually, and the necessity of working out every part's relation to every other part gave the worker a mental stimulus, and, therefore, a higher mental development. The finished product was all his own; the desire for self-expression, which every man has, found an outlet through his work; and once having served his thorough apprenticeship, he worked largely by self-direction. Under our present highly organized industrial conditions, the making of a clock is subdivided into a large number of distinct operations. Each workman in a clock factory makes piece after piece of the same kind, principally by feeding material into a machine, but why he does it he need not know and usually is not told. We are putting the brains into the machine and into the management office, and making the workman a purely automatic adjunct. It is unquestionable that much of the present spirit of industrial unrest is Nature's protest against work without light, physical and mental.

This purely automatic, high-pressure work in closely crowded rooms is the most ominous feature of modern industrialism, its most serious aspect being the effect upon mental development. Scientific research has shown us that the monotonous rhythmic repetitions of the machine's motion and the monotonous rhythmic motion of feeding the machine, produce an hypnotic, deadening in-

fluence on the mind. The lower brain centers, controlling habits, are developed at the expense of the higher thinking centers. As the habit becomes ingrained, the worker becomes more lethargic and automatic, and almost as incapable of independent, intelligent action as the machine itself. Research further shows that the higher centers in the brain of such a worker are in danger of getting into a permanent, inelastic, hopeless set, if a lively stimulus is not supplied.

Further, there is in every individual a desire for self-expression, and if this cannot be had in one's daily work, nature will force an outlet for it. It cannot be dammed up very long; and when there is no outlet for it in the worker's daily task, it must come during his idle hours, and sometimes takes a form which leads to many of our most vexing sociological problems.

The situation, then, sifts down to this: Energizing work is decreasing; enervating work is increasing. In spite of the warnings of history, we are rapidly dividing mankind into a staff of mental workers and an army of purely physical workers. The physical workers are becoming more and more automatic with the sure result that their minds are becoming more and more lethargic. The work itself is not character-building; on the contrary, it is repressive, and when self-expression comes, it is hardly energizing mentally. The real menace lies in the fact that in a self-governing industrial community the minds of the majority are in danger of becoming atrophied, or at best, of becoming trifling and irresponsible, because of lack of continuous exercise in conjunction with the earning of a livelihood. The kind of citizenship that a republic needs cannot be built on forty-eight hours per week of automatic work. Fortunately, automatic work seems to be decreasing; the automatic motions are being put into the machines. In many cases the worker who formerly sat at a machine doing the same thing over and over, now handles a battery of machines which do the automatic work. But there is still a lot of monotonous, dragging work being done.

It is evident, then, that the general law of labor must be divided into two parts, namely, The Law of Energizing Work, which makes for progress, and the Law of Enervating Work, which makes for retrogression. Nearly all the work still done in the open air, where there is a dependent sequence of operations, involving planning on the part of the worker, is energizing work. Specific examples may be cited in farm work, railroad work, and the building trades.

Certain work done indoors, under good conditions of light and air, is also energizing; for example, the work of a toolmaker, a locomotive assembler, and a cabinet maker. The enervating work has come through the subdivision of labor in factories, so that each worker does one thing over and over in the smallest number of cubic feet of space. This type is recognizable at once in the routine of the garment worker, the punch press operator, the paper box maker, the shoe worker, and so on.

Aside from the broader factors, such as climatic conditions and racial characteristics, it is safe to say that the morale of a community depends upon the kind of work it does. A rural community of about twelve thousand people, having clean political conditions, a high moral tone, few jarring families, well-kept gardens, and a good average of intelligence, is a desirable place, from the manufacturer's viewpoint, in which to locate a factory. If a manufacturer locates in such a place and employs three thousand of the men, women and children in purely automatic, noisy, high-speed work, the town will change very materially in one generation. Its politics will become corrupt and its morals lax; its citizenship will lose their tidiness; in a word, it will become "a factory town." And what was once a good community with a high community efficiency, and therefore a safe place in which to invest money, becomes a town of low community efficiency and a constant menace to the industry itself. Every detail of the town's life is affected. Religion lags, while the amusement parks thrive on Sunday; for since the week-day work is repressive, an outlet for pronounced self-expression is demanded in the idle hours—or, to put it in another way, Nature goes on the defensive. The slowly up-built appreciation of the fine arts is quickly destroyed, for this cannot grow without harmony, orderly thought, and the desire to express ideals. Respect for law diminishes, for the law is put in the same class as an electrically wired strike fence. These significant changes are not the fault of the people who work; they are logical natural products of the work itself.

In the foregoing analysis Dean Herman Schneider arrives at a basic division of all work into two kinds: *enervating* and *energizing*. Note how this classification cuts across relatively less important distinctions such as outdoor and indoor or even skilled and unskilled labor.

THE FORM AND USE OF THE OUTLINE

As we have seen, the significant thing about an outline is the analysis which its content reveals. From the writer's point of view, the outline is important, not as a mechanical scheme for the grouping or display of topics, but as a stimulus to the analysis and classification of material. It may be only a temporary falsework, to be removed when the construction of the composition has been finished. Certainly it should never be exhibited conspicuously to the reader, but should make its influence felt chiefly by the symmetry and orderly arrangement of the main units in the completed structure. For example, there should never be anything resembling the following bald announcement:

The subject of x will be discussed under three heads: *a*, *b*, and *c*.

The writer of such a purely mechanical introduction, instead of subordinating the outline, is leaning heavily upon it and is advertising his dependence. An incidental outline, such as a table of contents or a series of guide headings, may serve to clarify the composition without forcing itself unduly upon the reader's attention. The formal plan should not be exhibited conspicuously in the text. As a rule, it should merely be indicated by the logical structure of the composition. Certainly the writer should not follow his guide headings too literally. In the interest of smooth transitions he should put aside the framework when the preliminary stages of the writing have been completed.

Headings. It will be recalled that an important element of mechanical form is the use of headings to indicate the principal and subordinate divisions of a piece of writing. These headings, although they are distributed over the va-

rious pages, do not really form a part of the text. No direct reference should be made to them within the paragraphs. Their omission would not affect the essential structure of the composition in which they occur. Their purpose is to show the reader at a glance the relationship between the units of the text, and to furnish him with a convenient set of topical references with which to identify those units. When they are assembled in their proper sequence, the headings and subheadings form a table of contents, or, in other words, a summarized outline of the whole composition. The placing of the two kinds of headings in the text has been illustrated on pages 19 and 20.

The "contents" form of outline. The table of contents is by far the most useful type of outline for technical writing. It is especially recommended for use in the preparation of papers, theses, and the various kinds of inspection-trip and laboratory reports. It is equally helpful in note taking, for it provides a convenient method of setting down the leading topics and sub-topics in a lecture, a chapter, an article, or any other form of discussion. Because it stimulates the habit of watching for the other person's outline and of selecting and arranging significant data, the making of a table of contents is far more beneficial to the student than the copying of long passages of text or the transcription of shorthand notes.

The table of contents, by grouping topics which may be used as headings and subheadings within the text, thus serves a double purpose for a given composition and is useful alike to the writer and the reader. Not the least important of its advantages is its simplicity. For many purposes, it may consist only of a single series of headings, arranged in logical sequence and without notation, as in the following outline for a typical laboratory report:

	PAGE
Object	
Theory	
Apparatus	
Procedure	
Results	
Conclusions	

Brief as this outline is, it may serve to represent satisfactorily the successive units of the average laboratory report. Even for a long report, the outline need not ordinarily be expanded beyond a single set of subdivisions for such of the units as are treated in detail.

If there are several parts of the general theory, several pieces of apparatus, or several steps in the procedure, a series of topics may be included for each of the subordinate branches of the report. Neither the object nor the conclusion should require more than a concise paragraph of text, and consequently, neither need be subdivided. The question of subheadings does not usually apply to "Results," since the material included under this head is put in tabular or graphic form.

Suppose, for example, that the report summarizes a series of experiments made with samples of wood to determine the relative penetration of paint applied by three methods: brushing, dipping, and spraying. The *object* could be stated in a single sentence, or, at most, in a paragraph. The *theory*, if the discussion were sufficiently detailed, would cover fully two phases of the application of paint, the mechanical and the chemical. One phase would deal with the question of pressure as a factor in inducing the penetration of paint, and the other, with the purely chemical results of contact between paint and wood, regardless of how the contact might be brought about. In a long report, then, there would be two subdivisions of the theory. The section on *apparatus* could be treated briefly, since it would be

confined to an explanation of the simple equipment for applying the paint and for tracing the depth of its penetration. It is evident that the *procedure* would call for a threefold division, owing to the fact that three distinct methods of applying the paint are tested. The *results* would appear in the form of tables showing the penetration in centimeters as obtained in the successive readings, and, since a comparison of the three methods is sought, the *conclusions*, interpreting the results, could be summed up compactly under one main heading. The outline of the complete report, including subheadings, would therefore stand as follows:

	PAGE
Object
Theory
Mechanical Action of Paint on Wood
Chemical Action of Paint on Wood
Apparatus
Procedure
Brushing Tests
Dipping Tests
Spraying Tests
Results
Conclusions

It is apparent that the use of subdivisions is determined chiefly by the writer's purpose and by the scale on which the composition is treated. In a brief report, consisting of five or six pages of text, a single series of topics may be ample to indicate the organization of the material. In a longer report or a thesis, the need for subdividing becomes greater in proportion to the added detail. The following outlines for an inspection-trip report on a filtration plant are identical in their main headings and in their general plan. The only difference is that one suggests a more detailed treatment of the subject than the other.

	PAGE		PAGE
The Intake Pier		The Intake Pier	
The Pump Pit		Location	
The Settling Reservoirs		Construction	
The Filters		The Pump Pit	
The Clear Well		Construction	
		Equipment	
		The Settling Reservoirs	
		Location	
		Construction	
		The Filters	
		Construction	
		Operation	
		Cleaning	
		The Clear Well	

Except for their general plan, the foregoing outlines are not recommended as models to be followed closely. Neither is it suggested that any attempt be made to secure artificial symmetry or balance in the number of subheadings. Adherence to rules of external form should never be allowed to destroy the individuality or dictate the plan of anybody's writing. What should determine each writer's outline is his purpose and his particular background of information. Whereas one person may be in a position to write informally and interestingly on all three subtopics under "Filters," for example, another may not be able to contribute more than a brief paragraph on the general topic. The prescribed mechanical form is not intended as a mold in which to fix any writer's ideas, but only as a convenient means for showing his particular treatment of the subject. It is expected that his handling of the details will be distinct and individual.

Although, in general, the "contents" type of outline will be found the most useful in technical writing, other forms may sometimes be desirable for special purposes. If a de-

tailed analysis of a complex subject is wanted, the student may wish to use the familiar kind of outline which combines notation with indenting of subdivisions, and which more or less resembles the formula indicated below:

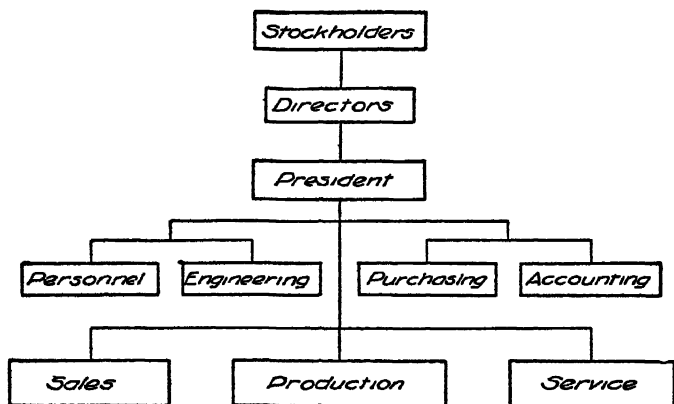
- I. Introduction
 - A.
 - B.
- II. Body
 - A.
 - 1.
 - a.
 - b.
 - 2.
 - a.
 - B.
 - 1.
 - a.
 - b.
 - 2.
 - a.
 - C.
 - 1.
 - 2.
 - a.
 - b.
- III. Conclusion
 - A.
 - 1.
 - 2.

Purely as an exercise in analysis, the making of such an outline is worth while, since each group of the subdivisions which agree in rank presents a special problem in classification.

For practical purposes, however, the foregoing plan, with its elaborate notation and its ready-made formula of "Introduction," "Body," and "Conclusion," is preferably set

aside. When the student is obliged to supply a contents page he must think more about the subject and less about the external form of the outline. He must reject vague or preliminary units and must limit himself to those which deal definitely with the subject and which have the length and form characteristic of topical headings. Having in mind the possible use of these "contents" headings within the text, he can visualize not only the sequence and subordination of units but the detailed development of the composition as a whole.

Charts and graphic outlines. Another type of outline is that which shows both a vertical and a horizontal symmetry for the principal divisions and subdivisions. An illus-



tration of this form is the Graphic Chart for Self-Criticism on page 331. This kind of outline is frequently used in business or industrial organizations because of its graphic representation of the relationship between departments and of their principal functions. The National Cash Register Company, for example, has adopted a form similar to this one as a standard for permanent charts. It is valued not only because it is clear to the reader but also because it compels the maker to analyze his material more completely

than he would be likely to do in developing the conventional type of outline.

A final example of a special form of outline adapted to a particular purpose is the "organization chart," which is really a graphic outline. (See page 72.) By means of this device a variety of relationships may be shown at a glance, and lines of responsibility or subordination may be readily traced. Suppose, for example, that one wished to show the departments in a factory which has a "line-and-staff" type of organization. Although it would be possible to indicate by topical headings that the working units belonged to two essentially different branches and that certain minor departments belonged to each branch, the inter-relationships of all can be shown more clearly by graphic means, as in the foregoing chart.

The variety of outlines which may be used for special purposes is practically unlimited. Whether a particular outline shall consist of a simple series of topics, a detailed arrangement of subdivisions, or a graphic picture, must depend upon the use for which it is intended. It should be remembered that the form, in any case, is only a mechanical device. The real value of the outline is measured by the amount of thought that lies behind it.

CHAPTER IV

CLEAR STATEMENT OF IDEAS

OBVIOUSLY, the most important single requirement in any piece of writing is clearness. Whatever the writer's purpose may be,—whether to state a fact, to answer a question, to explain a principle, or to tell a story,—in every instance, his first problem is to make sure that his exact meaning is carried over to the reader. Normally, he writes a statement, not as an exercise in writing, but as a means of conveying his thought to some one else. In order to do successfully any of the things which writing may accomplish, he must begin by expressing his ideas in language that cannot be misunderstood.

No one, except possibly a criminal, writes with the deliberate intention of confusing his reader. We may assume that the average writer sincerely wishes to be understood. His language may be vague, but it is so because his thinking is muddled, or because he lacks the skill to express what he really thinks. The reader is not in a position to distinguish between these two explanations for vagueness. From his point of view the person who knows his subject but cannot state his ideas clearly is in exactly the same case as the person who is hopelessly ignorant. It may be that the writer himself does not realize how little he knows about a subject or how awkward he is in expressing his ideas until he tries to phrase a clear definition of a term or a satisfactory answer to a question. Writing a sentence to order may thus prove as revealing as well as a wholesome form of discipline.

A prerequisite to intelligent self-criticism is the ability

to differentiate between subject matter and form. In proportion as any one is already familiar with the subject matter of a piece of writing, he is tempted to read into the text what he himself knows, and not what is actually said. Now form, as a means to clearness, is so important that it may well be studied apart from subject matter. This may profitably be done by regarding a statement as an algebraic formula for the expression of grammatical relationships. A statement which is absolutely clear and correct, grammatically, may be absolutely false, scientifically; for example:

Helium is cheap and plentiful, but is so highly inflammable that its use in balloons is unsafe.

It is very important that any one who holds fallacious concepts should state them clearly, in order that others may know the nature and the extent of his misunderstanding. The form of a statement is what makes possible an appraisal of the subject matter.

The student's writing of explanations and discussions in his technical studies affords constant opportunity for testing the clearness of his language and for increasing his skill in expression. In some respects, the conditions under which he writes are better for these purposes than any that could be devised in connection with an exercise in English as such. In his technical work, the student does not write a clear statement merely in order to write a clear statement. He writes it for the definite, practical purpose of communicating certain ideas to some other person. He has a motive for expressing his thought in unmistakably clear language. Hence, his effort to reduce his ideas to a definite, complete statement will automatically increase the accuracy of his knowledge and improve the logic of his reasoning.

THE SENTENCE AS THE BASIS OF CLEAR EXPRESSION

The writer's problem is really that of producing clear sentences. At any given moment, his thinking is done in terms of a single sentence. This does not mean, of course, that the form of his sentence is not influenced by the surrounding context, for most sentences, except answers to questions, are written as parts of larger units of composition. Nor does it imply that the general purpose and outline of the whole composition are to be forgotten. It does mean that the writer's task, for the moment, is to make a clear sentence out of the statement on which he may happen to be engaged. An extended passage, whether paragraph or chapter, cannot be clear unless the individual sentences which compose it are clear. And a sentence, it should be remembered, is primarily a single assertion.

It is a good general principle that a sentence must not only fill its place in a sequence of statements but must also be complete within itself. Although not all sentences can be readily understood apart from the context, the majority of them can be self-explanatory. At least, in the sense of being a definite structural unit, every sentence should be entirely self-contained. From this point of view, as well as from the standpoint of convenience, one is justified in studying detached sentences in order to learn something of the principles which govern their form.

THE DIFFICULTY OF WRITING CLEAR SENTENCES

Nearly every one has a certain degree of confidence in his own ability to write a clear sentence. The average student may well feel, as a freshman once expressed it in a preliminary examination, that he has "already had a thorough course in paragraphing and *sentencing*." Before this is taken for granted, however, it is worth while to make

sure. Even the best writers may profit by a review which will demonstrate and strengthen their power to express ideas clearly. Others will need not only a review, but, in addition, some intensive drill in the elements of grammar and logic.

Incompleteness of subject matter. The easiest kind of sentence to write should be a simple statement of fact. Here is one from a student report:

Current is produced by two generators having a capacity of 30,000 kilowatts.

This sentence raises some doubts, because it is not complete enough to set forth all the facts. For example, has each of the two generators a capacity of 30,000 kilowatts, or does this amount represent their combined capacity? There is considerable difference between these two interpretations. To say that the writer did not have full information on this point is to admit that he was not ready to write the sentence. If he has the information, or can get it, he is obviously the one who should make the necessary revision. The critic is concerned only with pointing out that the sentence as it stands is not clear, because there is not enough material. In other words, the sentence lacks unity.

Excess of subject matter. Clearness may be violated not only through incompleteness of subject matter but also through excess of material in the sentence. The incomplete sentence is like an underexposed negative for a photograph. There is not enough detail to produce a clearly defined image. On the other hand, a sentence containing too much material is like a photographic plate that has been exposed more than once. The details get in one another's way. If there are more than enough ideas in a sentence to make a single assertion, the surplus material obscures the central thought which the sentence is meant to express.

Even a short sentence may have too many ideas if its

parts, instead of being unified, are different and unrelated. A long sentence, on the other hand, may be perfectly clear if its various elements unite to convey a single thought or a single impression. The important thing is that every word in the sentence shall belong there. A word or phrase which does not contribute something to the main thought of the sentence necessarily subtracts something from the intended meaning. It cannot remain in the neutral position of mere excess baggage. Whether a given part of a sentence should be retained or omitted, depends upon whether that part tends to clarify or to confuse the central thought.

Here is an example of a sentence which, although brief, contains too much material for unity:

The factory was built in 1908 and covers more than an acre of floor space. (See "*illegitimate and*" constructions, p. 353.)

Whatever may have been the writer's intention, the sentence, as it stands, deals with two wholly different and obviously unrelated ideas. Trying to combine these ideas is like trying to add apples and potatoes. There is no common basis for combining the parts of the sentence into a single assertion. Compare with it the following long sentence in which a number of subordinate ideas are held together by a clear, though complex, logical relationship and are made to contribute to a single main thought:

Since there cannot be more than one price in the same market, each company that brings to market a part of the necessary supply will make a profit corresponding to the advantages it enjoys over its most unfortunate competitor.

If an expression is so formed as to make two separate assertions, it should either be written as two sentences or be revised to make one assertion. The following example of the so-called "comma splice" illustrates this fault:

The mixture is now heated, this is done in large vats.
It may be written:

The mixture is now heated. This is done in large vats.

Or, unless there is some special reason for emphasizing the separate assertions, the two ideas may be combined in a single statement, for example:

The mixture is now heated in large vats.

THE GRAMMATICAL BASIS OF SENTENCE CLEARNESS

It thus becomes evident that a sentence cannot be clear, and, in fact, cannot be a sentence at all, unless the words are so chosen and combined as to make *a single assertion*. Fundamentally, the assertion is made through a finite verb, which forms the "predicate" of the sentence. The assertion is made about a word or a group of words which we call the "subject" of the sentence. The subject and the predicate stand in almost a mathematical relationship. Thus, the formula for a typical sentence may be written:

(Subject)	(Predicate)
a	is equal to b
	(The verb which makes the assertion is "is.")

Substituting in the formula, we have the same essential twofold division in a longer sentence which deals with specific ideas instead of symbols:

(Subject)	(Predicate)
The <i>square</i>	<i>is equal</i>
inscribed on the hypo- tenuse of a right-angle triangle	to the sum of the squares inscribed on the other two sides.

In these examples, a clear statement, or assertion, is made concerning the relation between two expressions which we have designated respectively as "the subject" and "the predicate" of the sentence.

A phrase without a finite verb is a mere fragment of expression; for example, "The indestructibility of energy."

When a finite verb is added, we have an assertion, "Energy is indestructible." The first form is non-committal and evasive; the second is definite and positive.

To appreciate the importance of the finite verb in expressing such a relationship, we have only to try to analyze, or disentangle, a group of words like the following:

Whether the field magnetism reverses the direction in the motor according to the left-hand rule reversing the direction of rotation.

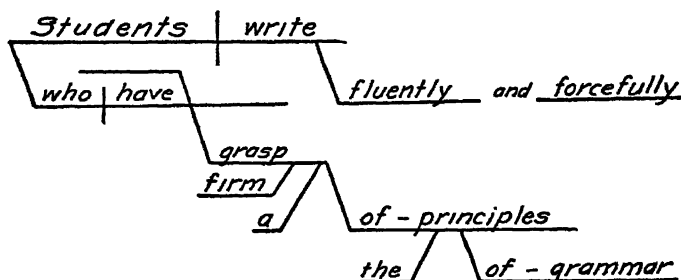
Of course we may be unfamiliar with the meaning of the technical terms, but primarily our bewilderment is caused by the form of the quotation and not by the subject matter. Let us not forget that the form of a sentence may be judged quite apart from its content. As it stands, the passage is merely a jumble of words. It is so far from asserting, or even indicating, a relationship between the words that it would seem of doubtful value, even in a notebook of fragmentary jottings. In the language of everyday talk, "It doesn't make sense"; or in terms of grammar, "it does not parse." The only definition of a sentence which would include it is the fallacious one, not recognized in books, but sometimes acted upon in practice: "A sentence is a group of words beginning with a capital letter and ending with a period." The whole trouble with the example cited is that it lacks a finite verb, and therefore has no predicate.

All this may sound very elementary. Such terms as "subject," "predicate," "clause," "phrase," "modifier," and "antecedent" will probably be remembered by most students as more or less faint echoes from their usually brief study of formal grammar. All too frequently it happens, however, that those who remember the grammatical terms have forgotten the principles for the sake of which the terms exist. Still more often, they have failed to apply those principles in the construction and criticism of their own

sentences. Just how far this is true of any individual student is a matter for the student himself, and for his instructor, to determine. At least a brief review seems desirable at this point, even for the best-prepared students, because most violations of sentence clearness, however they may be labeled, are really mistakes in grammar. A further reason for such a review is that grammar, which is the algebra of composition, includes the constructive principles that govern logical thinking and writing.

As we have seen, a sentence may be composed of few or many words, provided that the words are so combined as to make a single assertion. The subject and the predicate, which together make the assertion, are known as the "main clause." Either or both of them may be modified by dependent elements consisting of words, phrases, or clauses, and these, in turn, may be modified by other elements. The basis of a sentence may consist of only two words, for example: "Students write."

Or the same thought may be expanded, as in the sentence outlined below:



In each sentence the act of writing is asserted of the subject, "students." The more complex thought is expressed by the addition of modifying elements to the subject and the predicate. The second assertion is limited to one group of students, and is concerned not only with the act of writing

but also with the manner in which the act is performed.

Analysis of sentence elements. When the subordinate elements of the subject are examined, it is found that they break up into numerous subdivisions. For example, as shown by the diagram, "students" is modified, or limited, by the subordinate adjective clause, "who have a firm grasp of the principles of grammar." Within this clause, the objective modifier, "grasp," completes the meaning of the transitive verb "have." The noun "grasp," if left standing alone, would be incomplete. The adjective "firm" therefore is used to explain the kind of grasp; and the adjective phrase modifier "of principles," with its subordinate elements, answers our mental inquiry, "grasp of *what?*" With reference to these modifiers, "grasp" is known as the "base." The noun "principles" is explained by the prepositional phrase "of grammar." Without the articles "a" and "the" before "grasp" and "principles," respectively, the relationship of these words to the rest of the sentence would not be clear, and the sentence would not sound like the smooth, idiomatic English of connected discourse.

In the same way, the predicate can be resolved into its elements. The compound adverbial modifier, "fluently and forcefully," modifies the verb "write," and thus completes the meaning of the assertion. It will be noted that the relationship between the sentence elements is indicated in one or more of three ways: by connective expressions, such as "who"; by agreement in form, as in the plural form "write" to correspond to the subject "students"; and by the order in which the words are presented.

The third of these methods is especially important. Suppose, for example, that the last four words in the subject were transposed to read "the grammar of principles." It would be hard to guess what this phrase might mean, but it would evidently be something very different from "the

principles of grammar." The student will observe that, in an English sentence, the relationship between words is indicated mainly by the order in which the words are given. In some foreign languages, a combination of words like "The officer the criminal had seen," would be unmistakably clear because one of the nouns would have a nominative case ending and the other would have the accusative, or objective, case form. In English, we depend more upon word order than upon inflections. In testing the clearness of a particular arrangement, the student will do well to read his sentence aloud. If the phrasing sounds natural and smooth, the chances are that the relationship between the words is clear.

The normal word order. The normal order of words in an English sentence calls for the subject first and the predicate second. As we have seen in the longer sentence quoted above, the modifiers of the subject and those of the predicate are grouped with their respective divisions. Single-word adjective modifiers precede the base, as "a" and "firm" before "grasp." Adjective clause and phrase modifiers follow the base word, as "who have a firm grasp of the principles of grammar" after "students," and "of grammar" after "principles." In the predicate, adverbial modifiers normally follow the main verb, as "fluently and forcefully," after "write."

If every sentence stood entirely alone, the normal order of the main sentence elements could regularly be followed, and the writer's problem would thus be greatly simplified. As we have already noted, however, sentences rarely exist in a detached, independent state. Their association with other sentences requires frequent variations from the normal order, for three important reasons. First, in the interest of smoothness, it is desirable to vary the pattern of the individual sentences. Second, for the sake of continuity within

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the paragraph, it is often necessary to shift predicate modifiers in order to link the thought of the main clause more closely with that of the preceding sentence. Finally, there is the familiar practice of transposing sentence elements for the sake of emphasis.

The periodic sentence. A simple transposition of adverbial, or predicate, elements is often made for variety and emphasis, as in the following example:

<p>Partly because they have developed an efficient sales organization, and partly because they have kept down the cost of production without sacrificing quality in the product,</p> <p>the <i>manufacturers</i></p>	<p><i>have been able</i> to secure for the X machine a virtual monopoly.</p>
--	--

(Subject of Main Clause)

(Predicate of Main Clause)

In this type, known as the "periodic" sentence, the main clause is not completed until the end of the sentence is reached. In the opposite type, or "loose" sentence, the main clause comes first, with the subordinate elements of the predicate following in the normal order, thus:

The manufacturers have been able to secure for the X machine a virtual monopoly, partly because they have developed an efficient sales organization, and partly because they have kept down the cost of production without sacrificing quality in the product.

Transitional sentences. Predicate elements are often shifted forward for transitional purposes, as in the following algebraic forms:

Equally important with a in determining the value of c is b .

For this reason, before suggestions are passed upon by y , they are first referred to x .

In the same manner, observations were made on the relation between c and d .

To meet this demand, the x equipment has been modified in two ways.

Since a has been found equal to b , then c , which is equal to a , must also equal b .

Each of these transposed expressions indicates a link with a preceding sentence. If the predicate elements were not placed at the beginning, there might be a lack of continuity in the thought, and hence, of clearness in the paragraph as a whole. A writer who thinks consecutively makes constant use of the transposed order for connective purposes.

Co-ordinate and subordinate elements. Of two related sentence elements, one may be principal and the other, subordinate; or the two may be logically and grammatically parallel. In the latter case, they are said to be "co-ordinate." A careful writer constantly emphasizes the relative importance of sentence elements by using connective and balancing expressions. In this way he makes the grammatical form of a sentence reflect the intended meaning. It is the logical purpose, of course, which gives a sentence its *pattern*, that is, its structure and emphasis.

In the so-called "compound" sentence, the parallelism between two or more co-ordinate clauses is based upon some central principle of agreement or contrast. The parts are joined by "and" or "but," or by other connectives which correspond to these familiar expressions of addition and subtraction. In the following sentence, for example, each clause is grammatically an independent assertion, capable of standing alone, and yet the two clauses belong in one sentence. The idea of mechanical control is common to the two clauses.

a. The coal is fed by means of automatic stokers, and the ashes are removed by mechanically operated conveyors.

The relation between grammatically independent assertions may be one of contrast, as in the following sentence:

b. A charge of powder has potential energy, but a flying bullet has kinetic energy.
(whereas)

The parallelism of these two assertions is indicated by the balancing of their grammatical forms. They are grammatically equal, and they are also logically parallel.

If the elements are related but are not equal, their grammatical form should indicate which is principal and which is subordinate. The confusion which results from writing two unequal assertions in grammatically parallel form is shown by the following sentence:

c. The flint clays are the most refractory, and they were used in making the molds.

The two statements made concerning the flint clays are evidently not intended to stand on terms of equality. One of them explains the other. The principal clause tells that the flint clays were used. The subordinate clause tells *why* they were used. The grammatical form should make clear which clause is principal and which is subordinate. Revised, the sentence reads:

Because the flint clays are the most refractory, they were used in making the molds.

Whether sentence elements shall be made co-ordinate, therefore, depends upon whether the ideas which they represent are logically parallel. As we have seen, two clauses in a compound sentence may exist side by side if there is a central thought which unites them on a common basis, as in the following:

d. The clay was put down in layers, and each layer was rolled.

It is clear that these two statements represent closely associated steps in a process, and that they are of equal importance. The writer's chief concern is that the co-ordinate elements shall be identical in their grammatical form. The following compound sentence illustrates the confusion arising from even a slight difference in form between clauses which are meant to be co-ordinate:

The clay was put down in layers, and each layer rolled.

Because of the omission of one word, the second part of this sentence becomes misleading. The student may now formulate the general rule governing such cases; namely, that *elements which are meant to be co-ordinate should agree in grammatical form*. More important than any rule, however, is a feeling for grammatical balance and grammatical completeness. A ready appreciation of correct sentence form is well worth cultivating. It is not only the mark of a skilled writer and of an educated person but is also one of the surest guarantees of clearness.

COMMON VIOLATIONS OF SENTENCE CLEARNESS

When considered in detail, the possible mistakes in sentence form are almost innumerable. Comprehensive collections of specific errors are found in all the handbooks, but no matter how varied a collection may be, some individuals of perverse originality may be depended upon to add new mistakes to the list. The offences which are common enough to justify discussion before a large class, however, are fortunately not so numerous, and the principles by which they are corrected are fewer still. Most of the mistakes, regardless of how they may be classified, are essentially violations of good grammatical form. The remedy, therefore, is a thorough drill in the fundamental principles of grammar.

Grammatical incompleteness. The general principle governing sentence form is that *the relation of all sentence elements to one another and to the main clause should be evident*. In order that this relationship may be clear, all the sentence elements must be present and must be given their proper form.

Specifically, this principle forbids such forms of grammatical incompleteness as the following:

a. OMISSION OF THE SUBJECT: Have received your letter.
Write instead, I (or we) have received your letter.

b. OMISSION OF THE PREDICATE: Object of the experiment, to determine the viscosity of a sample of cylinder oil.
Write instead, The object of the experiment was to determine the viscosity of a sample of cylinder oil.

c. OMISSION OF ARTICLES: Pressure on bottom of pit sufficient to counteract pressure of ground water.
Write instead, The pressure on the bottom of the pit is sufficient to counteract the pressure of the ground water.

d. OMISSION OF AUXILIARY VERBS: A crucible was filled with water, and the water evaporated.
Write instead, A crucible was filled with water, and the water was evaporated.

e. OMISSION OF CONNECTIVES: This test proved conclusively the generator could not be operated under full load.

Write instead, This test proved conclusively that the generator could not be operated under full load.

Compare also, The experiments he made and later described in an article, pointed the way to several improvements in the design of these machines.

Write instead, The experiments which he made, and which he later described in an article, pointed the way to several improvements in these machines.

f. OMISSION OF PREPOSITIONS: The tests made this time were more conclusive.

Write instead, The tests made at this time were more conclusive.

It will be noted that several of the examples of incomplete grammatical form which have been cited are the result of a mistaken sort of economy in language. Whether intentionally or through unconscious imitation of others, a writer often adopts a telegraphic or a conversational style. The telegraphic form, perhaps, is carried over from his note-

book. The conversational style probably sounds more natural by reason of its omissions. Many persons would rather say, in talking, "I told him I was going" than "I told him that I was going." In written discourse, however, the inclusion of seemingly unimportant words is hardly an indication of formalism or of pedantic affectation. Neither is it mainly a question of correctness. The chief reason for supplying the missing sentence elements is that clearness of statement is possible only through grammatical completeness.

Grammatical inconsistency. Another class of sentence faults that are commonly committed may be characterized as violations of grammatical consistency. The principle governing such cases is, that *sentence elements which represent logically parallel ideas should have parallel grammatical form*. This principle is sometimes applied in the correction of sentences which are grammatically incomplete, as in example *d* above, in which "was filled" and "was evaporated" are corresponding verbs in the clauses of a compound sentence. In its general application, however, the principle is broader, since it covers such questions as agreement in tense and in point of view. Typical examples of grammatical inconsistency are given below.

a. MIXING OF ACTIVE AND PASSIVE FORMS: Immediately after removing the castings from the molds, they are sent to the cleaning department.

Write instead, Immediately after the castings have been removed from the molds, they are sent to the cleaning department. (*Both verbs are now passive.*)

b. MIXING OF TENSES: This arrangement was made in order that combustion may be improved.

Write instead, This arrangement was made in order that combustion might be improved.

c. CHANGE FROM THIRD PERSON TO FIRST OR SECOND: If this rule is followed, you do not need to use a template.

Write instead, If, etc., a template need not be used.

Compare also, After the engine was started, I took readings at intervals of five minutes.

Write instead, After the engine was started, readings were taken at intervals of five minutes. (*This change not only brings about grammatical consistency but converts the passage into the characteristic impersonal style.*)

d. INCOMPLETE PARALLEL CONSTRUCTION: This method is convenient, safe, and one that is reliable. (*Series indicated, but not carried out.*)

Write instead, This method is convenient, safe, and reliable.

Compare also, Electricity is used both to operate the cranes and for driving the emergency pumps.

Write instead, Electricity is used both to operate the cranes and to drive the emergency pumps. Or "for operating"—and "for driving."

e. MISLEADING PARALLELISMS: The scale was then assembled and calibrated by means of standard weights.

Write instead, The scale was then assembled and was calibrated by means of standard weights. Or better, After having been assembled, the scale was calibrated by means of standard weights.

(These two verbs represent two distinct steps, of which only the calibrating is modified by the phrase "by means of standard weights.")

Compare also, This condition of the water is known as "temporary hardness" and is caused by the bicarbonates of calcium and magnesium.

Write instead, This condition of the water, which is known as temporary hardness, is caused by the bicarbonates of calcium and magnesium.

Or, This condition of the water, which is caused by the bicarbonates of calcium and magnesium, is known as "temporary hardness."

(Either clause may be made the principal one, according to the writer's purpose. The important thing to note is that the two clauses are not of equal rank. One must be subordinate to the other.)

MISCELLANEOUS FAULTS OF SENTENCE STRUCTURE

The remaining types of common errors in sentence structure are caused chiefly by disregard of the principles which govern correct grammatical form. Although the mistakes

will be called by special names for convenience of identification, and although a minimum of grammatical theory will be suggested in connection with their revision, it should be remembered that for these, as for the preceding examples, the best basis of criticism is a sound knowledge of grammar. We are still concerned with the relation of a modifier to its base, of a pronoun to its antecedent, and of various other sentence elements to one another.

Misplaced modifier. We have already noted that *a modifier should be placed as near as possible to its base*. If this principle is not followed, the modifier will attach itself to the nearest expression which may serve as a base. An example is the following sentence from a student's review of Benjamin Franklin's "Autobiography":

Franklin now bought out his partner, who was always drunk, with the aid of two friends.

This is the type of inspired blunder which reveals the writer's meaning sufficiently to insure a joke at his expense. In this particular example the humorous effect is heightened by the substitution of a suggested picture for a statement of fact. The sentence is so loosely strung together as to call for complete revision, but its most conspicuous fault is that of *misplaced modifier*. The phrase modifier, "with the aid of two friends," is too far from its base, "bought out." Another possible base intervenes and the modifier associates itself readily with the wrong expression. Whatever further revision is made, the obvious first step is to transpose the misplaced phrase, preferably to the beginning of the sentence.

Dangling participle. A participle should refer definitely to one of the sentence elements with which it is associated. Thus, in the sentence,

Running rapidly, he soon reached the station,

the participle "running" is understood to modify "he." A sentence containing such a participle should be written so that *the subject of the action in the participle is also the subject of the main clause*. When this principle is not followed, the meaning of the sentence is obscured, and often becomes ridiculous, as in the following example of an unattached, or "dangling," participle:

- a. While waiting for my car, an automobile struck me.
Write instead, While waiting for my car, I was struck by an automobile. (Note that "I" is not only the subject of the main clause but is also the subject of the action in the participle, "waiting.")
 Or, "While I was waiting for my car, an automobile struck me." (In this case, the missing subject is supplied in the completed subordinate clause, "While I was waiting," etc.)

Since technical writing is usually put in the third person and the passive voice, the trouble with participles most frequently occurs in such sentences as the following:

- b. "Having finished the first experiment, the apparatus was ready for the second." (Here there is no subject for the action in the participle, "having finished.")
Write instead, "After (or As soon as) the first experiment was finished, the apparatus was ready for the second."
 A possible but hardly acceptable substitute would be the Latin "ablative absolute" construction, "The first experiment having been finished, the apparatus was ready for the second."
 c. "Knowing the voltage, the resistance can be calculated."
Write instead, "If the voltage is known, the resistance can be calculated."
 d. "The planimeters were calibrated, using a check plate."
Write instead, "The planimeters were calibrated by means of a check plate." (In other words, avoid the active participle with the passive, and if necessary, avoid the participial construction altogether.)

When the imperative form is used, as in a set of instructions, the participle properly relates to the subject (understood) of the main clause; for example:

- e. Using hydrogen di-sulphide, (*you*) test the solution to determine the presence of arsenic.

An unattached elliptical clause has an affinity for the subject of the main clause, and is therefore treated in the same way as the dangling participle.

EXAMPLES:

- f. When six years old, my family moved to St. Louis, and I entered school there.

Write instead, When I was six years old, my family moved to St. Louis, and I entered school there.

- g. When heated, a white precipitate appeared on the surface of the mixture.

Write instead, "When heated, the mixture showed a white precipitate."

- h. One of the worst of these wandering modifiers is "due to," as in the sentence, "So far, no tests have been made to show the forces acting on a resilient culvert due to fill and traffic loads." Note the confusion in the possible reference of this expression. It is well to avoid "due to" altogether.

Involved construction, or oversubordination. A good general rule for sentence clearness is to avoid having more than one class, or rank, of subordinate clauses. In the following sentence, for example, the clauses which modify the subject and the predicate, respectively, represent only one degree of subordination. In other words, they are only one remove from the main clause.

was invented

"The *theory*

that all matter is built
up out of atoms

to explain certain
phenomena which be-
long to chemistry."

If modifying clauses branch off from the subordinate ones,

the relation between the parts of the sentence is more difficult to grasp. Even when sentences having a second or a third degree of subordination are not actually misleading, they are likely to impose an unnecessary tax on the reader's attention. The following sentence illustrates the danger of oversubordination:

- a. The fighting at Liverpool last night, which resulted in the death of two rioters, who were shot by Hussars in defending five prison vans occupied by riot prisoners whom the mob attempted unsuccessfully to release, has not tended thus far to improve the situation except as it has helped to keep the peaceably disposed outside the strike area.

Since newspaper style, as a rule, is more highly simplified than any other, this quotation is all the more remarkable because of its source. The reader can probably understand the sentence in its present form, but it should be made easier for him. The obvious revision is to make two or more sentences of the long one.

If the subordinate ideas are sufficiently related to the central thought, they need not be put into separate sentences but may be united compactly within the original sentence. In such cases the elimination of one or two superfluous clauses not only makes the meaning easier for the reader to grasp, but at the same time clarifies the writer's thinking. Compare, for example, the following ways of saying the same thing:

- b. It is because the phrase form of expression encourages vagueness that most instructors insist that all statements which are made in answer to questions be put in the form of complete sentences.
- b'. Because the phrase form of expression encourages vagueness most instructors insist that all answers to questions shall be put in the form of complete sentences.

Sometimes one encounters an extreme example in which

oversubordination is almost a triumphant achievement. Take a deep breath and then try reading the following supersentence from a discussion of theories of energy:

- c. As soon as certain numbers of the different kinds combine, their energies become so modified, through modification of their energitias by reciprocal energizement, that the free atoms of the same kinds which are present are not energizable attractively by the energy of the combined atoms, and the energizabilities of the combined atoms become so modified, through reciprocal energizement, that they are no longer energizable attractively by the energy of the free atoms, so that under the conditions, there is no such reciprocal energizement between the combined atoms as would bring them into combination.

Reading such a sentence is like making a plunge for distance. It is a question of how far the reader can go before he must come up for air. The initial difficulty is not that he is unfamiliar with the subject matter. He is so overwhelmed by the flood of subordinate clauses in the sentence that he cannot even begin to analyze the content.

Faulty reference of pronouns. We have already seen the importance of linking a modifier closely with its proper base. A special phase of this problem has to do with the relation between pronouns and their antecedents. *Every pronoun should have an antecedent, and should unmistakably refer to its antecedent.* Failure to observe these requirements is often the explanation for lack of clearness in a sentence.

- a. ANTECEDENT OMITTED: For handling the heavy equipment *they* use traveling cranes.

(This particular fault is sometimes known as "indefinite *they*.")

Compare also, The dust and oil were removed, *which* caused the engine to run smoothly.

(The word "which" refers, by implication, to the entire statement, "The dust and oil were removed," but an independent sentence cannot

stand as the antecedent of a pronoun. In strict grammar, the sentence as a whole is not greatly improved when an antecedent for the pronoun is supplied and is placed in apposition with the statement concerning the dust and oil, as in the substitute form, "The dust and oil were removed—a precaution which insured smoother operation of the engine." It is better to recast the sentence completely.)

Write instead, Removal of the dust and oil caused the engine to run more smoothly.

- b. ANTECEDENT AMBIGUOUS: All materials used in these valves are analyzed by skilled chemists as soon as *they* reach the factory. (Make the antecedent refer unmistakably to "materials.")

Pronouns, like participles, tend to attach themselves to the subject of the main clause. However, they are also governed by the principle that a modifier has an affinity for the nearest expression which may serve as a base. In the foregoing sentence the pronoun "they" is influenced by both of these considerations, and its reference is nicely balanced between "materials" and "chemists." We suspect that the writer had "materials" in mind, but we are under no obligation to interpret the sentence for him. It is his duty to make the statement so clear that only one interpretation is possible.

Idiom. Idiom is partly a question of word order and partly a matter of usage in the association of certain words. In the sentence, "It was yesterday very cold," the adverb "yesterday" does not follow the English word order. Compare the phrase, "for this reason," in the sentence,

The experiment was for this reason not successful.

These sentences might be literal translations from a foreign language. They are extreme cases, but they illustrate a prevalent form of awkwardness, against which many writers need to be on their guard.

If the fault is in the choice of words to be used together, the chances are that the sentence which contains them is

obscure as well as awkward. The following sentence is an illustration:

The well-known affinity of this substance to oxygen causes rapid combustion.

Since the correct combination is "affinity . . . for," the substitution of the preposition "to" brings the reader up with a start. The unfamiliarity of the phrase may even suggest to him that a different meaning from the usual one is intended. At any rate, there is a break in the smooth flow of language and in the clear connection between ideas.

Here again, the writer's best practice is to read the passage aloud. He cannot obtain the proper combination of words by reasoning. Idiomatic combinations are not formed by logic or by etymology, but by usage. His only safety is in knowing whether a combination *sounds right*. This knowledge, in turn, comes from his familiarity with the practice of the best writers and speakers.

Split infinitive. The separation of the particle "to" from the verb with which it unites to form an infinitive phrase, should be carefully avoided. In Arnold Bennett's play, *What the Public Wants*, a dramatic critic who takes pride in his English is represented as being highly indignant because one of his sentences has been made to read,

This performance is to in all probability be followed by three others.

Split infinitives are not always so conspicuously awkward, and their use may not always be incorrect; but any one who employs the form risks his reputation as a careful writer. Usually, this fault is corrected by shifting the adverbial expression forward. Thus,

Properly to write an infinitive, one should place the adverbial modifier first. (*Not* "To properly write," etc.)

Repetition. A reader is certain to be annoyed by the recurrence of words or sounds, unless he is convinced that the repetition is intentional and justifiable. In a sentence like the following actual, though horrible, example, the repetition of the word "punch" is evidently sheer carelessness on the writer's part:

A punch that will punch holes faster than any other punch on the market is the multiple punch.

Unless it is needed for clearness or emphasis, a word should not be used a second time within the same sentence, and preferably not within the same paragraph.

Not less objectionable than the repetition of words is the accidental recurrence of similar sounds. In reading the phrases "The river improvement movement," or, "However, whatever measures may be taken," the reader is forced to pause and notice the awkwardness of the accidental rhyme. This is another way of saying that the reader momentarily thinks about the form of the expression rather than about the subject matter. He does so, it should be noted, because the writer has thought about the subject matter exclusively and has neglected the form.

Awkward combination of words. It is evident that any marked peculiarity in the form of an expression is a violation of clearness, since it draws attention from what is being said to the way in which it is put. The reader temporarily forgets the subject matter and thinks only of the style. Awkward or ill-sounding expressions may be clear in themselves, but by reason of their unusual form they bid for the reader's attention in competition with the thought which they are meant to express. If they are very strange or awkward, they may easily bring the writer into ridicule. It is not our present purpose to discuss and illustrate the possibilities of such mistakes, but only to cite a few typical examples as a warning. By reading his com-

positions aloud, the student can detect awkwardnesses which might otherwise go unnoticed. And even though many of his compositions may not be intended for oral delivery, they should be smooth enough to avoid offending the ear.

The sentences which follow will suffice to illustrate this error:

- a. It was found that the time lost cost more than the saving effected justified.
- b. Successful paper substitutes making possible utilization of small pieces of wood waste hold forth attractive possibilities to experimenters.
- c. The water-insoluble calcium carbonate formed sinks to the bottom of the beaker.

Smoothness. Although the technical writer is chiefly concerned with the avoidance of awkward combinations, he should not overlook the positive aspects of smoothness. Even a sentence which does not pretend to be literary should have rhythm. In other words, there should be a smooth, even flow of language and a natural cadence in the rise and fall of accents. The individual phrase, no less than the sentence as a whole, should have a certain harmony and balance in the arrangement of its parts. An example is found in the familiar phrase, "life, liberty, and the pursuit of happiness." A different arrangement of the series would not only sound less pleasing; it would not be so clear. If this expression seems too literary to be typical, the same principle may be applied to a very practical example:

This metal was chosen because of its resistance to corrosion, low cost, and accessibility.

By arranging the units of the series so that the long expression comes last, as in the phrase beginning "life, liberty," we improve the sentence both in smoothness and in clearness:

This metal was chosen because of its accessibility, low cost, and resistance to corrosion.

Or we can emphasize the balance between members of the series by repeating "its" before the last two parallel expressions:

This metal was chosen because of its accessibility, its low cost, and its resistance to corrosion.

The student may cultivate an ear for pleasing combinations of words, as he does for correct idioms, by *reading aloud* from the works of standard authors. Thus he will gain not only a feeling of smooth and appropriate phrasing but also a heightened appreciation of logical emphasis.

LOGICAL ANALYSIS AS THE FINAL TEST OF CLEARNESS

A sentence exists for the sole purpose of expressing the writer's thought. Whether it accomplishes its purpose, even after it has been put into correct grammatical form, is a question which only the writer can answer. If the sentence is clear, the reader will accept it at its face value. The writer alone is responsible for making sure that his language conveys exactly his intended meaning.

Whether the writer is aware of the fact or not, the form of his statement reveals pretty fully the extent of his knowledge, and perhaps also, the state of his mind. Not infrequently one finds a parallel for the famous answer quoted in *The Diary of a Harvard Freshman*:

Polarized light, as I understand it, is a subject that is not very well understood.

Or possibly the statement reveals not so much inadequate information as mental confusion. Here is an example from a test paper in descriptive geometry:

If a plane be passed through a given plane perpendicular to a plane, it will lie in that plane.

It is as if the writer had merely said, "I find descriptive geometry very difficult." In sentences like the two examples

just cited the writer may not tell us much about the subject, but he says a great deal about himself. In order to keep the reader's attention where it belongs, the writer must be sure that his statement deals exclusively with the subject.

Sometimes, a close analysis of the completed sentence reveals the disconcerting fact that the writer has had no thought to express. Perhaps his sentence merely affirms, in good grammatical form, an obvious or axiomatic truth which goes without saying. Note the following example:

The marketability of investment securities largely determines the ease with which they can be sold.

This sentence may sound rather impressive at first. It has correct grammatical form and is clear. Upon second reading, it proves to be a perfectly clear statement of a self-evident fact. Its logical absurdity may not be quite so evident as that of another sentence from a prize collection,

If the affair had not terminated as it did, the outcome would have been different.

but the principle is the same in both cases. The sentences cancel out, and their formula may therefore be written,

$$1 = 1, \text{ or possibly, } 0 = 0$$

Intentionally or not, a writer is likely to confess his ignorance by the form of his expression, as did the student who wrote in an examination,

The difference between a direct-current generator and an alternating-current generator is that one of them has a commutator.

One need not be an authority on electrical engineering to recognize the inadequacy of this answer.

Usually, a sentence that has been put into correct form contains a statement of something. The question for the writer to determine is whether that something is exactly

what he intended to say. Here is a sentence from a set of directions for excavating:

The trenches may be dug by machinery, but they must be filled with shovels.

The intended meaning of the sentence may be guessed without difficulty, notwithstanding the ambiguous phrasing. The suggestion of buried tools will be avoided and the logical balance of the sentence will be improved, if the expression "by hand" is used to parallel "by machinery."

What a writer actually says may be a precise contradiction of his intended meaning, or it may be a perfect articulation of his thought. Between these extremes lie various degrees of approximation. Because there are so many possible gradations between absolute accuracy and absolute inaccuracy, precision in language is far more difficult to achieve than precision in mathematics. And yet, in all essential points, the analogy between the logic of numbers and the logic of words remains valid. A person who realizes the importance of clearness and accuracy in the presentation of mathematical concepts may well be expected to appreciate the value of these qualities in a piece of writing and to strive accordingly for clearness in the statement of his own ideas.

CHAPTER V

LOGICAL GROUPING OR DEVELOPMENT OF STATEMENTS

FROM one point of view, the grouping of sentences into paragraphs is purely a question of mechanical form. A page of broken text is more pleasing in appearance and more easy to follow than a page of solid type. Along with headings, illustrations, and other mechanical aids to clearness, the indention of paragraphs has come to be looked upon as an indispensable feature of "page layout." The modern reader can hardly appreciate the historic condition in which the expanse of writing was continuous, and the character ¶, known as the "paragraph,"¹ was merely placed at the beginning of a line to indicate a division of the text.

So accustomed is the average reader to the indention of paragraphs that he recoils involuntarily from a page of solid text as being too formidable an undertaking. Every one who has read an old-fashioned long novel—for example, by Sir Walter Scott or George Eliot—has experienced at least momentary hesitation upon encountering a page or two of continuous description. Unless the reader is very conscientious, he may even decide to pass over such parts of the story and leaf on until he comes to a page of conversation. And yet, if he can overcome his initial feeling of dismay and read ahead, he may find the long paragraph well worth the extra effort. In substance, as well as in appearance, the older novel is probably more solid than most of the recent works of fiction with which he is familiar. The

¹ From Greek *para* = beside, and *graphein* = to write.

and of its typical structure to make it the basis of a whole philosophy of composition.

THE NORMAL ORDER IN PARAGRAPH STRUCTURE

In the same way that we identify a typical sentence as one having a normal order of subject and predicate, we can point to a typical paragraph as one having a topic sentence which is followed by a series of developing statements. Note how this order is observed in the following brief paragraph:

The writing of a technical article is a worth-while experience, because it compels the writer to know something about the subject. When he makes a speech, he may conceal his ignorance by talking rapidly and by dodging embarrassing issues. When he puts a statement down in black and white, however, he knows that his mistakes will eventually be discovered. In justice to himself, therefore, the writer should verify every doubtful point and look up every missing fact before he submits an article for publication. It is no disgrace to be uninformed about a matter and then look it up; but no one can afford to remain unenlightened and proclaim his ignorance in print.

The writer states his subject at the beginning and then seeks to establish his point in a series of sentences which explain his meaning and bear out his main assertion. He rounds out the paragraph with an emphatic statement in which the main point is restated and applied. The last sentence has a certain "whip-snap"³ quality which makes the end of the paragraph conclusive.

CONNECTION BETWEEN PARAGRAPHS

Although the "normal" paragraph structure is that illustrated by the foregoing quotation, there are various modifications in paragraph form. For one thing, the paragraph,

³ For examples of conclusive, well-rounded paragraphs, the student is referred to the *Essays* and the *History of England* by Thomas Babington

like the sentence, is frequently influenced by the surrounding text. In such cases, it must not only be a self-contained unit of discourse but must also be one of a series of paragraphs which combine to develop a larger subject.

The most common sign that the paragraph is part of a longer composition is the use of an opening sentence which is partly or wholly transitional. Suppose, for example, that a paragraph similar to that quoted above begins with this sentence:

"The second advantage to be gained from the writing of a technical article is an increased familiarity with the subject matter.

It is evident that the preceding part of the discussion has dealt with some other "advantage," and that the subject ⁴ of the whole composition or, at least, of that section of it which is here indicated, is something like, "Advantages to be gained from the writing of technical articles." In somewhat the same way as a geologist constructs the skeleton of a fossil animal by working from significant parts, we could develop the outline of a whole composition by following the indications which appear in the transitional parts of certain paragraphs.

The opening sentence frequently indicates or summarizes the content of the preceding paragraph, as in this sentence:

"Besides giving practice in composition, the writing of a technical article compels the writer to know something about the subject."

For two reasons at least, the transition sentence just quoted is preferable to the other. Unlike the first example, it does not merely suggest but explicitly points out the relationship

Macaulay. (*See pages 108-111.*) If he will imitate the structure of Macaulay's paragraphs, he will probably absorb something of the vigor and clearness of Macaulay's style.

⁴The title should not be confused with the subject. Since the title is usually brief and suggestive, it is not meant to give a full and explicit statement of the subject. The title of this composition, for example, might be "Learning by Writing."

between the paragraph which follows and the text which precedes it. Moreover, it avoids the appearance of perfunctoriness and uniformity. We can easily imagine the writer of the other sentence as beginning all his paragraphs in the easiest possible way by saying: "The first advantage," "The second advantage," and so on, up to the "*n*th advantage." His beginning suggests that he writes according to a formula instead of naturally and with pleasing variety. As we have seen in the discussion of "Logical Organization of Material," a writer should have a complete outline, but should not allow it to formalize his composition. The danger of this fault is nowhere so great as in the beginnings of his paragraphs. (See page 66.)

A practiced writer like Macaulay contrives to give each paragraph structural completeness and at the same time to connect it closely with others in the group. The paragraph may introduce or summarize the discussion as a whole, or it may develop a subordinate aspect of the subject. In either case, it will be found to be self-contained as a unit and closely linked with the adjacent text. As in the passage quoted below, however, the continuity of the series is established more by logical interdependence of ideas than by transitional devices.

The first sentence states the theme of the passage as a whole and indicates the probable method of development.

In the next two sentences and elsewhere in the paragraph, a negatively stated qualification clears the way for positive emphasis on the main idea. Note that this "not . . . but" logical pattern corresponds to exclusion in a definition; that is,

The perfect historian is he in whose work the character and spirit of an age is exhibited in miniature. He relates no fact, he attributes no expression to his characters which is not authenticated by sufficient testimony. But, by judicious selection, rejection, and arrangement, he gives to truth those attractions which have been usurped by fiction. In his narrative a due subordination is observed: some transactions are prominent; others retire. But the scale on which he repre-

the writer explains the idea by showing what it is not, as well as by telling what it is. Incidentally, the repetition of this form emphasizes the connection between sentences and gives structural unity to the paragraph.

sents them is increased or diminished, not according to the dignity of the persons concerned in them, but according to the degree in which they elucidate the condition of society and the nature of man. He shows us the court, the camp, and the senate. But he shows us also the nation. He considers no anecdote, no peculiarity of manner, no familiar saying, as too insignificant for his notice which is not too insignificant to illustrate the operation of laws, of religion, and of education, and to mark the progress of the human mind. Men will not merely be described, but will be made intimately known to us. The changes of manners will be indicated, not merely by a few general phrases or a few extracts from statistical documents, but by appropriate images presented in every line.

The same "not . . . but" logical form is made to link the second paragraph with the first.

Note how the topic idea, "details which are the charm of historical romances," is developed by comparison and by specific examples, including literary and historical allusions.

The phrase "inseparable conjunction and intermixture" echoes "intersperse" above. The correspondence between these expressions gives close-knit logical structure to the paragraph.

If a man, such as we are supposing, should write the history of England, he would assuredly not omit the battles, the sieges, the negotiations, the seditions, the ministerial changes. But with these he would intersperse the details which are the charm of historical romances. At Lincoln Cathedral there is a beautiful painted window, which was made by an apprentice out of the pieces of glass which had been rejected by his master. It is so far superior to every other in the church, that, according to the tradition, the vanquished artist killed himself from mortification. Sir Walter Scott, in the same manner, has used those fragments of truth which historians have scornfully thrown behind them in a manner which may well excite their envy. He has constructed out of their gleanings works

Note the allusions by means of which Macaulay carries forward his reference to Sir Walter Scott and clinches in specific terms his comparison between the historian and the novelist.

which, even considered as histories, are scarcely less valuable than theirs. But a truly great historian would reclaim those materials which the novelist has appropriated. The history of the government, and the history of the people, would be exhibited in that mode in which alone they can be exhibited justly, in inseparable conjunction and intermixture. We should not then have to look for the wars and votes of the Puritans in Clarendon, and for their phraseology in *Old Mortality*; for one half of King James in Hume, and for the other half in the *Fortunes of Nigel*.

A paragraph is omitted, but the transition phrase "thus written" connects equally with the foregoing paragraph.

The two ideas "vivid" and "practical" are first developed together in parallel phrases. Later, the emphasis shifts to "practical," which is the main idea in the paragraph.

Again comparison, or analogy, is used to give point and force to the argument. . . .

The instruction derived from history thus written would be of a vivid and practical character. It would be received by the imagination as well as by the reason. It would be not merely traced on the mind, but branded into it. Many truths, too, would be learned, which can be learned in no other manner. As the history of States is generally written, the greatest and most momentous revolutions seem to come upon them like supernatural inflictions, without warning or cause. But the fact is, that such revolutions are almost always the consequences of moral changes, which have gradually passed on the mass of the community, and which ordinarily proceed far before their progress is indicated by any public measure. An intimate knowledge of the domestic history of nations is therefore absolutely necessary to the prognosis of political events. A narrative, defective in this respect, is as useless as a medical treatise which should pass by all the symptoms

attendant on the early stage of a disease and mention only what occurs when the patient is beyond the reach of remedies.

Here we return to "the perfect historian," the starting point of the passage. This paragraph, like the opening one, is general and is phrased somewhat more abstractly than the two middle paragraphs. Note the retrospective or summing up, effect of the phrase, "the contemplation of imaginary models."

A historian, such as we have been attempting to describe, would indeed be an intellectual prodigy. In his mind, powers scarcely compatible with each other must be tempered into an exquisite harmony. We shall sooner see another Shakespeare or another Homer. The highest excellence to which any single faculty can be brought would be less surprising than such a happy and delicate combination of qualities. Yet the contemplation of imaginary models is not an unpleasant or useless employment of the mind. It cannot indeed produce perfection; but it produces improvement, and nourishes that generous and liberal fastidiousness which is not inconsistent with the strongest sensibility to merit, and which, while it exalts our conceptions of the art, does not render us unjust to the artist.

METHODS OF PARAGRAPH DEVELOPMENT

Broadly speaking, the paragraphs which are not used for introductory, transitional, or summary purposes are of two principal kinds, depending upon the method by which they are developed. One kind, which may be called the "assembled" type, is made up of associated statements which cluster around a single topic. The other kind, which may be called the "reasoned" type, consists of a series of sentences which lead toward a definite conclusion. In this type, the thought grows organically, so to speak, as a result of the writer's thinking; whereas, in the "assembled" paragraph, the sequence of sentences is less clearly fixed,

and the paragraph grows by accretion. An assembled paragraph has a general plan or pattern, and may therefore be tested for completeness, but it does not round out a definite stage in the development of an idea.

Examples of the assembled type of paragraph, in varying degrees of looseness, are especially common in technical writing. Here is a typical one from a set of instructions for testing fireproof floors:

DIRECTIONS FOR HEAT TESTS

The heat obtained shall be measured by means of standard pyrometers, under the direction of an experienced person. The type of pyrometer is immaterial so long as its accuracy is secured by proper standardization. The heat should be measured at not less than two points when the main floor span is not more than ten feet, and at one additional point when it exceeds ten feet. Temperature readings at each point are to be taken every three minutes. The heat determination shall be made at points directly beneath the floor so as to secure a fair average.

The foregoing paragraph is a sufficiently extreme example. It will be noted that the sentences are not combined to develop a statement, but are brought together only to complete a rather scattered list of instructions. They have a sort of unity, in that they all belong under the same general heading, but their association is casual rather than inevitable. Neither can one sentence be said to grow out of another as in a logically developed paragraph. It is true that a certain degree of connection is brought about by repetition, or echo, as of "pyrometer" in the second sentence and "point" or "points" in the fourth and fifth sentences. There is not a close connection, however, either in the form or in the sequence of statements. The last sentence, for example, could be interchanged with the third, and no violence would be done to the general plan of the paragraph. On the contrary, the change would be an improvement. In their present arrangement, the sentences tend to fall

apart. They are grouped beneath a heading, but they do not unite to develop a thought.

At the opposite extreme is the kind of paragraph which results from the analysis of an idea. It is not pieced together, but thought out. It owes its compact structure, not to the writer's skill in arranging a sequence of sentences and joining them with connectives, but rather to his close concentration and his logical thinking. The course of his reasoning automatically determines the order of statements and the choice of connective expressions. Contrast the following paragraph with the one on "Directions for Heat Tests":

I often wish that this phrase, "applied science," had never been invented. For it suggests that there is a sort of scientific knowledge of direct practical use, which can be studied apart from another sort of scientific knowledge, which is of no practical utility, and which is termed "pure science." But there is no more complete fallacy than this. What people call applied science is nothing but the application of pure science to particular classes of problems. It consists of deductions from those general principles, established by reasoning and observation, which constitute pure science. No one can safely make these deductions until he has a firm grasp of the principles; and he can obtain that grasp only by personal experience of the operations of observation and of reasoning on which they are founded.

In this paragraph, which is quoted from Thomas H. Huxley's address *Science and Culture*, an idea is introduced and is gradually developed until a definite conclusion is reached. One statement grows logically out of another, and the sentences are thus held together not only by connective expressions but also by the interdependence of ideas. Incidentally, it may be noted that Huxley's paragraph, although entirely clear, does not follow the so-called "normal" order in paragraph development. Instead of a conventional topic sentence with a direct line of developing

statements, there is a transition phrase, followed by a statement of the false idea which the paragraph is intended to contradict. Huxley's treatment of the subject shows that a paragraph can have variety of form without sacrificing any essential quality. His paragraph is, in fact, a striking illustration of logical sequence and close-knit structure.

At the two extremes there is thus a very marked difference between a paragraph in which the details are simply grouped for convenience, and one in which the statements represent consecutive steps in a process of reasoning. The student is most often called upon to write the "assembled" kind, in which he sets down information. This is especially true at the beginning of his course, when the emphasis is placed chiefly on observation of data. In the more mature stage of his training, in which he is required to explain or interpret facts, he will find use also for the close-knit type of paragraph which is the result of reflective thought. An inspection-trip report may properly consist of nothing but assembled paragraphs. A laboratory report or a thesis calls for the addition of reasoned paragraphs, or "conclusions," and is judged by the soundness of their logic.

Even in the assembled paragraph sufficient attention should be given to connection and sequence to insure continuity in the progress of the reader's thought. In revising his paragraphs, therefore, the writer should try to test their connection as it will appear from the reader's point of view. The relation between two statements may be entirely clear to the writer because of what he "thinks between the lines," whereas the reader cannot be expected to follow any steps in the thought that are not fully expressed. The following paragraph illustrates the sort of "jump logic" which results when the writer takes for granted an intermediate stage in the paragraph development:

One day, while passing through the National Cash Register Factory, Mr. Patterson saw a woman heating something in a can over a steam radiator. He supposed at first that it was glue, but, upon questioning her, he learned to his surprise that it was coffee. . . . This was the beginning of the large modern cafeteria in which all employees may purchase excellent meals at reasonable cost.

The idea which the writer omitted was in substance the following:

He made a note of this situation and, upon returning to the office, issued orders that equipment should be installed to provide the employees with hot coffee.

When this connecting sentence is inserted, a gap is bridged which the reader could hardly be expected to cross without assistance. A test to be constantly applied in the criticism of paragraphs is that each statement shall prepare the reader to understand the one which follows.

Of course, the type of paragraph is always determined by the writer's purpose. In this sense, at least, every paragraph may be said to be "developed." If the writer's purpose is to describe a unit of apparatus, his paragraph is developed, or completed, when he has given the reader a clear picture of the individual parts and the set-up as used in an experiment. If his purpose is to explain the working of a piece of mechanism, his paragraph is fully developed when he has made clear the principle involved and its application to the machine under consideration. Consistent adherence to a central purpose will aid the writer in choosing his material and will prevent a "centrifugal tendency," or an inclination to branch off from a subordinate idea into a new paragraph subject. The writer should be able to think in terms of his subject throughout and to keep considerations of form subordinate. If he has a clear perception of what he wishes to accomplish, the technique of paragraphing will largely take care of itself.

THE QUESTION OF PARAGRAPH LENGTH

If the writer has a definite purpose, he will experience little difficulty in deciding the length of his paragraphs. For example, if his object is to make a transition between parts of the text, or to group related statements arbitrarily, as in a set of directions or specifications, two or three sentences may suffice. On the other hand, a paragraph which describes, explains, introduces, summarizes, or does any of the other things that may be necessary in the body of a composition, may include a dozen sentences, of various lengths. Obviously, no fixed rule can be laid down to determine how long a paragraph should be. The length, as well as the form and content, must be determined by the use for which the paragraph is intended.

An example will show how the length of paragraphs is determined in practice. The entire passage quoted below, although it is evidently taken from a longer composition, deals with one subject, "Automatic Sprinkler Systems."

In the wet type of automatic sprinkler system, water under pressure is in the pipes continuously and its action is instantaneous upon the opening of the sprinkler head. Because of its simplicity and its quick action, the wet system should be used whenever conditions will permit. It should not be used in unheated warehouses or in other locations where there is danger from freezing. In the dry system, the pipes are filled with air under pressure instead of water, the water supply being held back by a "dry valve," as it is called, which is usually located in the lowest story of the building and protected against frost. In this system, when a sprinkler head opens, it releases the air pressure, which, in turn, allows the tripping or opening of the dry valve. When this valve is opened, the water rushes into the system and passes out at the open head. Manifestly, this system is slower in getting the water to the fire and is consequently less satisfactory than the wet system. The water supply for sprinkling systems is variously provided by elevated tanks or reservoirs, by city water pipes, or by fire pumps.

Good protection requires that at least two separate and independent sources of water supply be provided for each system, and that at least one of these be automatic, that is, continuously ready for immediate operation without the intervention of any human agency. Generally speaking, adequate pressure is of more importance than volume of water. A good volume should be provided, however, to care for a possible contingency. The elevated or gravity tank, if of good size, at a sufficient elevation, and properly safeguarded against freezing, forms a reliable primary supply. As a general rule, no gravity tank should be less than 10,000 gallons in capacity and it is all the better if it has a capacity of 25,000 or even 30,000 gallons. When gravity tanks are used for the primary supply, they should be placed at the greatest possible elevation above the highest line of sprinklers. The bottom of the tank should be at least twenty-five feet above the highest point at which the pressure is to be applied.

The writer may print the text as it appears, without a single indention except at the beginning; that is, he may regard the whole quotation as one long paragraph. Familiarity with the practice of writers in general, however, would lead him to reject such a unit as being disproportionately long. To print it as a solid piece of text would place an unnecessary burden upon the reader. To aid the reader, the material may be divided on the basis of certain practical considerations. How much of the text, for example, is devoted to "sprinkler systems," and how much to "water supply"? Are the two kinds of sprinklers treated successively or in a side-by-side comparison? Does the passage include a transition paragraph?

The practice of using such mechanical devices may be equally helpful to the writer in the development of his subject. If he has formed the habit of thinking in terms of paragraph units, we can imagine him indenting the various sections almost automatically as he writes. The making of such divisions is partly an exercise of his sense of proportion, but it is even more a by-product of his think-

ing. It means that he knows what he wishes to say about a particular phase of his subject, and that he realizes when he has finished saying it.

The question of paragraph length thus takes us back to the organization of material for the whole composition. Although the topics in the outline may not always be meant to designate paragraphs, yet, in general, every topic may be understood to stand for at least one paragraph of material. Suppose, for example, that a student is outlining the sort of autobiographical statement nearly always requested at the beginning of his college course. He may put down, or note mentally, such topics as the following:

Early training
Preparatory school work
Practical experience
Reasons for coming to college

Each of these topics might well be expanded into a paragraph. They are distinct enough to be treated separately, and each is important enough to deserve a paragraph of material.

A very practical consideration which may decide either the length of a paragraph or the advisability of trying to develop it at all, is the amount of information possessed by the writer. When a student who has written a brief and general paragraph asks, "What more can be said on the subject?" he really means, "What more can *I* say about it?" The difficulty is that he does not know his subject. Here are two paragraphs that illustrate the difference between full and meager information:

A.

An example of rapid production made possible by special machinery is found in the manufacture of fishing rods. One-piece metal casting rods which are slow and expensive to produce by hand can be made rapidly and cheaply by machinery.

A'.

An example of rapid production made possible by special machinery is found in the manufacture of fishing rods. A firm which had produced a few one-piece metal casting rods as an experiment received enough orders and inquiries to indicate a ready market for rods of this kind. Production was slow and costly, however, since the rods were hand-forged and hand-polished. Many pieces of metal were wasted, owing to the difficulty of getting a symmetrical taper by hand methods. The firm submitted the problem to a machine tool concern whose engineering department was noted for its success in designing special machinery. Within a short time a semi-automatic grinding machine was devised which turned out a perfectly shaped rod from a straight bar of rolled stock. In a demonstration test this machine produced rods of uniform quality at the rate of eight a minute.

At this point we may very well inquire, "When is a paragraph complete?" This question may refer either to form or to content. The second of the foregoing paragraphs, for example, appears to be of approximately average length. It is also well constructed. It follows the conventional pattern, since it begins with a topic statement and adds a series of sentences which expand or explain the main idea. The sentences are smoothly related to one another and are arranged in a sequence that is both logical and chronological. The paragraph does not merely come to an end, but grows toward a conclusion. Structurally, it is quite acceptable, but there is another test of paragraph completeness.

Judged by the purpose which it seeks to accomplish, even the improved paragraph on fishing rods is not wholly satisfactory. It is true that many specific details of background information are given. Such terms as "hand-forged," "straight bar," and "grinding machine" indicate familiarity with the subject. However, the term "rapid production" is a relative one. A comparison of speeds would therefore seem necessary to justify the use of this expression. Thus, from the standpoint of content, the paragraph is still

incomplete. The writer did not include sufficient data to answer an important question raised by his treatment of the subject.

TOPIC AND DEVELOPING SENTENCES

Many students fail to distinguish clearly between a paragraph idea and a sentence idea. They should be reminded that the difference between the two units is chiefly a matter of their potential development, or expansion. A sentence, as we have seen, is a group of words expressing a single idea. A paragraph is a group of sentences *developing* a single thought. A particular sentence may state a general idea which needs to be developed, or it may state a subordinate idea which contributes toward the development of the principal, or topical, thought. Suppose that, in a laboratory report, we find a sentence like the following:

The sample of river water was next tested for total solids.

The sentence is grammatically whole, but the general thought is clearly incomplete. The statement appears introductory. We are led to expect a description of the procedure which the experimenter followed in determining the total solids. In other words, the sentence contains a paragraph thought, and not merely a sentence thought. Suppose that, in another part of the same report, we read:

The weight of the total solids was found to be 0.36 grams.

The foregoing sentence evidently expresses a subordinate idea. Unlike the first example, it does not call for development. In fact, unless he were an expert at padding, the writer would have trouble in lengthening the sentence. Even if he succeeded in increasing its bulk, he would not be developing, but only diluting, the original. There is a fundamental difference between a subordinate statement, which aids in the development of a thought, and a topic

statement, which requires a collection of sentences to complete its meaning.

We have noted that some statements call for development, whereas others merely contribute toward the completion of paragraph ideas. Just how far a given thought should be developed, however, is not always easy to determine. If we say simply that a paragraph should be restricted to one subject, we do not really distinguish between a paragraph and a larger unit, as a whole composition, a chapter, or a book. Even the *Encyclopædia Britannica* deals with the one subject, "knowledge." In general, a paragraph should not be written on a subject that is too comprehensive to permit of specific treatment and of complete development within a space of one hundred to one hundred and fifty words. Instead of trying to settle such a question arbitrarily, however, we shall do well to decide it on the basis of the immediate purpose for which the paragraph is intended.

SMOOTHNESS IN PARAGRAPH DEVELOPMENT

Assuming that the writer has a clear idea of the scope and purpose of his paragraph, he must still give attention to certain details of form. We have already noted the importance of logical sequence and close connection between sentences as a means of insuring continuity in the development of the paragraph subject. In addition to this logical relationship between the statements within the paragraph, there should be continuity in style. A break in the smooth flow of language interrupts the progress of the reader's thought. Even though the statements may be closely related in content, their interdependence should be emphasized by consistency of outward form.

The most common violation of smoothness in paragraph development is the excessive use of short sentences.

Whether or not an implied connection exists between them, the sentences tend to fall apart, as in the following paragraph:

The scales tested did not prove to be accurate. They were not sufficiently sensitive for accuracy. The brass poise could be shifted one-tenth of an inch without affecting the balance. The observed weights did not agree with the standard weights. Neither was uniformity obtained in different loadings in which the same weights were used repeatedly.

To a certain extent, of course, a passage like this one presents a problem in sentence unity. Some of the statements could be expanded into longer sentences, with the result that greater smoothness in both sentence and paragraph form would be obtained. From the standpoint of the paragraph alone, the present arrangement is objectionable primarily because it offends the ear. A jerky, or choppy, effect is produced by the succession of almost uniformly short statements. The resulting style, which is sometimes called "asthmatic prose," should have no place in the average person's writing, however popular it may be with a certain school of contemporary novelists. As Huxley, Macaulay, Stevenson, and other masters of English prose have shown, the paragraph at its best has variety of sentence length, together with a smooth and almost imperceptible connection between its parts. In other words, the highest type of paragraph represents not a mere grouping of statements but a fusing of ideas.

CHAPTER VI

ACCURATE USE OF WORDS

THE most significant thing about the technical writer's vocabulary is that the greater part of it is not technical at all. To be sure, his profession, like every other, has its quota of specific terms. Just as a lawyer may speak of "torts" or a physician of "dysostosis," an engineer may use such words as "busbar," "laitance," or "polyphase," which are no less mystifying to the average layman. The technical man's possession of specialized words, however, should be taken for granted. He acquires them, not as a result of deliberate word collecting, but as a by-product of his technical studies. If he really knows a subject, he must have accurate knowledge of the specific terms which belong to it. Any discussion of the technical writer's vocabulary, therefore, should have less to do with specialized words, which he learns as a matter of course, than with the large body of language which he holds in common with other educated men.

From one point of view, the discussion of vocabulary should not be restricted to a single chapter, since every phase of composition involves a study of words. The aptness of a title, the clearness of a sentence, the accuracy of a definition, the appropriateness or effectiveness of a writer's style—any one of these may depend upon the choice of a single word. What was said of Flaubert, the French novelist and master of style,—that he was always searching for the final word to express a precise shade of meaning,—could be affirmed in some degree of every careful writer. Whether

a composition belongs to literature or to science, whether it is written for artistic or for practical reasons, there is always the problem of selecting and substituting until the word is found which exactly fits the writer's purpose.

To make the selecting process worth while, a writer should have both a large variety of words and a keen appreciation of their differences in meaning and use. In reality, these two phases of his equipment are closely related, since the mere ability to recall a word or to recognize it by sight does not signify possession of it. No one may be said to have a word in his working vocabulary until he can use it with ease and confidence, and with discrimination as well.

MALAPROPISMS

Up to a certain point in his training, the average student accumulates words almost unconsciously. Of the four thousand or so words which he has acquired by the beginning of his freshman year in college, there are many which he knows but vaguely, and which, unless he has the courage of his ignorance, he would hardly dare to use. Of course there are always some persons who do not realize how far they may be misunderstood or ridiculed, and whose reckless choice of words affords unlimited entertainment to their more discriminating associates. Shakespeare identified the type, as may be seen in Dogberry's official report of an arrest in *Much Ado About Nothing*:

Our watch have comprehended two aspicious persons.

Richard Brinsley Sheridan, in *The Rivals*, created the unforgettable character of Mrs. Malaprop, whose liberties with language may be illustrated by an outburst which she addressed to her sentimental niece:

You're as headstrong as an allegory on the banks of the Nile.

Incidentally, the generic term "malapropism" has been used ever since Sheridan's time to designate either an ill-fitting word or the perpetration of an offence against verbal accuracy. For, it should be remembered, "malapropisms" are not confined to fictitious characters and situations. They are common in real life, and they are by no means unheard-of in the writings of technical students. The freshman who entertained his classmates by stating impressively that "in order to improve our language we must cultivate vacuity," was far from being a rare exception.

Such violations of accuracy may be found occasionally, even in the works of writers who influence usage. A choice collection of advanced malapropisms is that cited by Professor Henry van Dyke in an address on "The Fringe of Words,"¹ from which the following extract is quoted:

The real perils of the English language to-day, in my judgment, lie not in expansion nor in contraction of vocabulary; but much more in a certain noisy carelessness or sloppy indifference; a failure to recognize that thought is desirable not only before speech but also in speech; an apparent numbness to the finer sense of words. The effects of this creeping paralysis may be observed constantly in streets and shops and ballrooms, and frequently in books and newspapers.

For example, a distinguished historian writes that he proposes to "assess" a certain character, when he has no intention of taxing it but simply means to estimate its worth. A popular novelist makes his hero leave a room "precipitously," yet without throwing him down the stairs or letting him leap from a window. An ardent advertiser proclaims the "slogan" of his ready-made clothing, although his purposes are all pacific. Even a philosopher, a Platonist, writes that certain plays "intrigue" him, when evidently he means not that they perplex him, but merely that they interest him.

¹ Delivered before The American Academy of Arts and Letters and published in "Academy Papers." Scribner's, 1925. *Used by permission.* Although the author's chief purpose is to show how poetry begets prose, he includes a clear analysis of the principal causes of bad prose.

Although the student should not be frightened into silence through fear of becoming ridiculous, he will do well to take stock of his words before he uses them. A wide-awake sense of humor will go far to save him from becoming a laughing stock for others, but even so, he must have a background of knowledge. His greatest risk, of course, is not that he will commit amusing and self-evident blunders, but that he will convey the wrong shade of meaning. Here is an example from a laboratory report. A series of tests were made on a compound which was advertised to increase the efficiency of gasoline. The first statement of the object of these tests was phrased as follows:

a. The object of these experiments was to vindicate the claims made by the manufacturers of the x compound regarding its power to increase the efficiency of gasoline.

The phrasing is rather clumsy, but the chief fault is evidently in the choice of words. The word "vindicate" is out of place, because it contradicts the idea of an impartial investigation and suggests a prejudiced attitude on the part of those responsible for the experiments. If the spirit of this word were carried out, the report would be merely a piece of special pleading for the manufacturers. The statement of the object was revised as follows to represent the experimenter's actual purpose and point of view:

a'. The object of these experiments was to test the validity of the claims made by the manufacturers of the x compound regarding its usefulness in increasing the efficiency of gasoline.

Some such problem in the choice of words is constantly arising in the student's everyday written work, and every problem offers opportunity for word study. This study is the more profitable because the words are considered not as detached specimens, but as vital parts of a connected

statement whose purpose and associations are clearly recognized. The development of a working vocabulary is best accomplished through habitual attention to appropriateness and effectiveness in the choice of words used in everyday communications. And yet, as a contribution to such development, there are several phases of specialized word study which the student will find helpful and, indeed, almost indispensable. Beginning with simple precautions against incorrectness or inaccuracy, the student may profitably give attention to the enlarging of his vocabulary and to the increase of his familiarity with the meaning, the origin, the history, and the associations of words. Such study, whether carried on formally or not, is a lifelong process, and any one's advancement in it at any given time may be taken as an accurate measure of the range of his contacts and the depth of his understanding.

SYMPTOMS OF INSUFFICIENT VOCABULARY

The lack of an adequate vocabulary is more apparent to others than to the person most concerned. By reading any one's manuscripts an outsider can usually find instances of repetition, of vague, bulky, or lifeless phrasing, or even of inaccuracy, which have escaped the writer's attention. One of the chief reasons why a certain amount of deliberate word study is recommended is that by this means the student may become "word-conscious" and may thus be prepared to criticise his own compositions effectively.

Repetition has already been cited as an offence against smoothness in the sentence. It has been pointed out that variety is needed, both to make a sentence pleasing and to give it proper emphasis. Even in a context which does not pretend to be literary, there is no excuse for such ill-sounding expressions as these:

- a. This shaft, in turn, turns the flywheel.
- b. Shutdowns due to breakdowns are preventable.

It may be that a particular combination of words is less offensive to our ear than to our sense of completeness. We feel that something is lacking—that the writer has lost an obvious opportunity to say a thing effectively. Compare these two sentences and note how emphasis is improved by variety in phrasing:

- c. Some commodities are luxuries, others are not; some are seasonal, others are non-seasonal.
- c'. Some commodities are luxuries, others are necessities; some are seasonal, others are staple.

Whether the explanation is ignorance or carelessness, the difficulty is basically one of vocabulary. The writer either does not have or does not use a sufficient variety of words.

By using a long and roundabout expression instead of a short and precise one, the writer runs the risk of making his sentence obscure or inaccurate as well as awkward. Compare the following statements, which are quoted from student reports:

- d. On each of the four sides of the circle which forms the boundary of the pump pit is a Corliss engine.
- d'. Placed at equal distances apart around the circular pump pit are four Corliss engines.

The first sentence is incomplete and is logically inconsistent. Unintentionally, no doubt, the writer becomes responsible for the novel observation that a circle has four sides instead of the traditional infinite number. The second sentence is more direct and concise, and is at the same time more accurate. Here again, the question is not so much one of sentence structure as of precision in the choice of words.

Synonyms as an index of adequate vocabulary. As we have just seen, the person who has a large working

vocabulary is able to express his ideas in the fewest possible words. It may be remembered that Herbert Spencer, an engineer who became better known as a philosopher, once laid down a principle of style which is called "The principle of economy." Spencer's view is summarized in the following paragraph quoted from his essay, *The Philosophy of Style*:

On seeking for some clue to the law underlying these current maxims, we may see shadowed forth in many of them, the importance of economizing the reader's or hearer's attention. To present ideas so that they may be apprehended with the least possible mental effort, is the desideratum towards which most of the rules above quoted point. When we condemn writing that is wordy or confused, or intricate—when we praise this style as easy, and blame that as fatiguing, we consciously or unconsciously assume this desideratum as our standard of judgment. Regarding language as an apparatus of symbols for the conveyance of thought, we may say that, as in a mechanical apparatus, the more simple and the better arranged its parts, the greater will be the effect produced. In either case, whatever force is absorbed by the machine is deducted from the result. A reader or listener has at each moment but a limited amount of mental power available. To recognize and interpret the symbols presented to him, requires part of this power; to arrange and combine the images suggested requires a further part; and only that part which remains can be used for realizing the thought conveyed. Hence, the more time and attention it takes to receive and understand each sentence, the less time and attention can be given to the contained idea; and the less vividly will that idea be conceived.

The application and the importance of this principle can be observed in every piece of good writing. Poetry is effective because it flashes images and ideas through the medium of a carefully chosen word or phrase. But in practical writing as well as in artistic literature the principle is regularly applied. A title, a definition, or an advertisement may likewise represent a careful search for the precise word

which makes possible condensed expression. Whether the writer's purpose is to convey a poetic image or to state a scientific truth, the process of achieving accuracy is the same. In either case, the writer must choose among possible words, or synonyms, until he discovers the one that exactly suits his purpose.

To some extent the simplest forms of everyday expression call for discrimination among synonyms. (See also page 243.) If the choice lies between two widely different words, as "combustible" and "inflammable," we need hardly hesitate. The distinction between "continual" and "continuous," "sewage" and "sewerage," or "consist in" and "consist of" requires somewhat closer thinking. Other words, more difficult to distinguish, may demand a correspondingly greater background of familiarity with their origin and their traditional associations.

Suppose, for example, that we have as a starting point the general meaning of "*at the same time*" to be expressed by a single word. According to the context and to the shade of meaning to be expressed, the word might be any one of the following:

synchronous
contemporary
simultaneous
coincident
concurrent
coeval

At first this variety of possibilities may seem bewildering. One could even be tempted to wish that the language contained but one word for the general idea, in order that the problem of selecting might be simplified. On second thought, however, one discovers that the language is the more expressive because of these specific words. Each word has its own shade of meaning and its own set of associations.

By using each word in a context appropriate to its peculiar sense, the student will find that the English language is the more precise by reason of its variety of words, and that the numerous synonyms, instead of confusing the writer, encourage him in the accurate expression of his thought.

THE CHARACTER OF THE ENGLISH VOCABULARY

It has been suggested that the writer frequently needs to know the origin and history of a word in order to use it with confidence. If he has studied Greek or Latin, or both, the student will recognize many words in modern English as having come from these sources. Or if he has not studied these languages, he can find the origin or etymology of a word by consulting a good dictionary (see page 242). Thus "tachometer," a word signifying a speed-measure, such as a revolution counter for use on a revolving shaft, is derived from *τάχος* (*tachos*), meaning speed, and *μέτρον* (*metron*), meaning measure. Its definition is explained by its origin, and may be remembered in terms of the parts which go to make up the word. Helpful as it is, however, a knowledge of the origin, or etymology, of a word does not entirely prepare one to use it in a sentence. So far as its literal meaning is concerned, the word "tachometer" might mean an instrument for measuring the speed of an automobile. In the early days of the automobile an attempt was actually made to use the word in this sense, but the public demanded instead the hybrid form "speedometer," and "tachometer" was restricted to certain other uses. Similarly, so far as the literal meaning of their parts is concerned, the two words "synchronous" and "contemporary," among the synonyms given on page 130, are precisely the same, though one is of Greek and the other of Latin origin. Thus,

GREEK

syn = with*chron* = time(*chronos*)*ous* = adjective suffix

LATIN

con = with*temp* = time(*tempus*)*orary* = adjective suffix

And yet no one would think of using the two words interchangeably. We may speak of "synchronous" motors, but hardly of "contemporary" motors. We may say that Shakespeare and Bacon were contemporary, but not that they were synchronous! It will thus be seen that a knowledge of literal meanings only is not a sufficient preparation for the accurate and effective use of words. Before a word really forms a part of one's working vocabulary, it must also be known in terms of its associations.

When we ask, "How did the language get all its words?" we are dealing with a very complicated problem. Mark Twain found one way out of the difficulty when he described the conversation of Adam and Eve regarding how the animals should be named. When Adam asked Eve why she called the dodo a "dodo" she replied, "Because it looks like a dodo."

As usual, there was wisdom mixed with Mark's humor, and for many words an explanation similar to Eve's must be accepted without further question. Many so-called "shop" terms, for example, have an obscure or an unknown origin; and even when their etymology can be traced, there may seem to be little connection between the technical applications of the words and their literal meanings. Such terms as "cam," "seat," "jig," "chuck," "drag," "cope," "lug," "grout," and "flask" are typical of the homely words which, through figurative use or accident, have come to have a technical meaning in everyday shop practice. The student who has had industrial experience will recognize this class of words and will be able to add many examples from

his own observation. Such terms have a certain raciness and a rugged expressiveness which corresponds to the flavor of cant words in sport, such as "luff," "bunt," or "lob." The meanings and associations of shop words can best be learned through actual contact with the things which they describe and with the atmosphere of which they form a part.

The history of most words can be found in the dictionary and in various treatises on etymology. With the aid of these works, we can trace words back toward their ancestral forms, we can group them according to their origin, and we can note the various ways in which they have been used since they entered the language. It is much like studying the ancestry and habits of certain immigrant groups that have entered the country from time to time and have contributed something of their own the while they have helped to modify the character of the nation as a whole. It is hoped that a brief suggestion at this point may lead the student to investigate further for himself the fascinating subject of the origin and use of words.

To go no farther back than the period extending from the fifth century A. D. to the Norman Conquest, we find the inhabitants of southern Britain speaking various dialects of Anglo-Saxon, a Teutonic language not unlike Modern German, which belongs to the same linguistic family. In a somewhat changed form, the language spoken by our Anglo-Saxon ancestors has come down to us as the basis of modern English. Our pronouns, numerals, and prepositions are Anglo-Saxon, and so are the names of many familiar objects. Such words as "house," "roof," "stone," "knife," "tree," "grass," and "ship" are typical, as also are the words "doom," "oath," and "deed," which define abstract ideas. The Anglo-Saxon words contribute an important element of strength to the language. They are usually short, many of them having but one syllable. Because

of their simplicity, their long tradition of race memories, and their nearness to the hearts and lives of the common people, they have a ring of sincerity. Moreover, the very shortness of the words gives them an explosive quality that makes them peculiarly emphatic. Note the forcefulness of expressions like *come to grips* or *stand pat*. The large proportion of Anglo-Saxon words used by Abraham Lincoln is often cited, not as an indication of his limited schooling, but as a sign of his kinship and sympathy with the common people.

In spoken language, especially, we find a large percentage of the short, native words. Even those who use long words of foreign origin in their writing generally prefer Anglo-Saxon words in their conversation. It is not, of course, that they identify them as Anglo-Saxon, but that they like words which are short, simple, and natural. The historic exception to this rule was Dr. Johnson, whose conversation, as recorded by the faithful Boswell, was made up largely of rumbling polysyllables. In commenting on people's unwillingness to pose for a picture, he said:

"Sir, among the anfractuosities of the human mind, I know not if it may be one, that there is a superstitious reluctance to sit for a picture."

On some occasions he forgot himself for the moment and expressed his thought in Anglo-Saxon words, as when, in speaking of a play, he said, "It won't live. It hasn't wit enough to keep it sweet." Then, as if to make amends, he restated the opinion in his characteristic style: "It has not vitality enough to preserve it from putrefaction." For Dr. Johnson not only talked like a book; he talked like a very learned book. As Goldsmith said of him, he would have "made little fishes talk like whales." Although his thinking was original and his character was free from affectation, his language is an excellent example of what happens

to conversation when Anglo-Saxon words are replaced by foreign or bookish ones. The pomposity of large words can be noted in the talk of Mr. Micawber, or of those persons we sometimes meet in real life who do not *live* but *reside* at a certain street address, who do not *buy* things but *purchase* them, who do not *begin* things but *inaugurate* them, and who do not find anything *hard* but find many things *difficult*, including, apparently, the use of natural language. Whereas the eighteenth century applauded elegant words and condemned familiar ones as "low," modern taste seems to appreciate the simple dignity of Anglo-Saxon words, which have always been the heart of the English language.

To praise the Anglo-Saxon part of the language is not necessarily to disparage the other elements which have been added from time to time. In their proper place, the foreign words have been of inestimable value. They have enriched the English language by adding to its expressiveness and by giving it variety, flexibility, and enhanced musical quality. The poetry of Chaucer, Spenser, Shakespeare, Milton, and Tennyson, and the prose of Newman, Arnold, Pater, and Ruskin would have been impossible without the mixture of smooth-flowing words of Latin and French origin to alternate with the shorter and somewhat more abrupt words from the Anglo-Saxon.

The time when the native English language began admitting foreign words duty free, so to speak, can be approximately determined. About a century after the Norman Conquest the influence of the conquering Normans on the Saxons began to appear in the language. Every one recalls the striking illustration of this in the word pairs cited in Scott's *Ivanhoe*. Where the Saxons had used "swine" to designate the animal on foot, the Normans introduced "pork," the French word, to indicate the same animal prepared for eating. The same was true of "sheep" and

"mutton," of "calf" and "veal," and of "ox" and "beef." French terms for cookery have been coming into the language ever since; and many of them, avowedly foreign, appear on the bill of fare, or perhaps we should say, the "menu" or "carte," of the more expensive hotels and cafés. The words "hotel" and "café," it will be noted in passing, are themselves of French origin.

The main fact is that the English language admitted these foreign words freely, naturalized them immediately, and used them to express certain shades of meaning that had not hitherto been recognized. The language might have grown in the same way as the German has grown, chiefly by the use of native roots and stems to form new words. For example, the German word for "hydrogen" is *Wasser-Stoff*, a literal translation of the Greek word, which means "water stuff" (*ὕδωρ* = water; *γεν* = kind or matter); that is, "water material." Many other German words have thus been formed to avoid the necessity of importing foreign words. In the fragmentary accounts of the changes through which the English language passed, following the Anglo-Saxon period, there is evidence that the use of this same form of compounding was considered as an alternative to taking over foreign words. Instead of "impenetrability," for example, a native compound form, *un-go-through-some-ness*, was seriously proposed. Although the English language has made compounds freely, it has never done so as a means of avoiding the admission of foreign words. Nor has there been any objection to the adopting of foreign words in their various grammatical forms. We have taken over "bonus," "quorum," "alibi," "vim," and "omnibus" from the Latin and have made English words of them. Then we have chopped off most of "omnibus" so that only "bus" remains, to designate a passenger-carrying vehicle, or perhaps a piece of electrical

equipment. In the same way, we have imported many words, especially scientific terms, from Greek sources. Just notice the number of words you can think of which are formed from the following Greek roots:

chron o logy (*chronos* ²=time; *logos*=word)

phon o graph (*phone*=sound; *graph*, from *graphein*
=to write)

photo meter (*photos*=light; *metron*=measure)

tele scope (*tele*=far; *skopos*=watcher)

thermo stat (*therme*=heat; *histanai*=to stand)

From the Latin we get a large number of scientific terms as well as words expressing abstract ideas on law, criticism, philosophy, and theology. Since Latin was for many centuries the international language of learned men, it was natural that the style of English scholars should be profoundly influenced by the Latin. This is a further excuse for Dr. Johnson, whose conversational Latinisms we have already noted. As a reminder of the many words in common use which have come from the Latin, the following may be cited:

centrifugal (*centri*, *centrum*=center; *fugere*=to flee)

via duct (*via*=way; *ductus*, from *ducere*, to lead)

manufacture (*manu*, from *manus*=hand; *factura*, from *facere*=to make) (Note the change in meaning as the word is now used.)

gravitation (*gravis*=heavy)

in dividual (*in*=not; *dividuus*, divisible, or *individuus*, not divisible)

The Italian branch of the Latin family has contributed especially words associated with art or music, such as "chiaroscuro," "piano," "studio," and "opera." From the

² A transliteration of the Greek spellings is used in this list, in order to emphasize the similarity between the Greek forms and the English derivatives. By referring to a Greek alphabet the student can readily find the substitute English letters to use in making such transliterations for himself.

French we derive words connected with the theater, such as "ensemble," "soubrette," and "foyer," to say nothing of more technical terms like "*mis en scène*." From the same source we have many words associated with clothing or fashions, such as "soisette," or "chiffon," if one may venture to cite examples. It would hardly be feasible to conduct the society page of a newspaper without a liberal sprinkling of French expressions, such as "début," "fiancée," and "née." The vocabulary of the automobile industry and of aviation has drawn heavily upon French sources. One has only to pass in review such words as "limousine," "garage," "sedan" (a new use for an old word), "chassis," "volplane," "aileron," and "hangar," to be reminded of this fact. Of recent French borrowing, also, are several words which express abstract ideas in politics or economics. The term "bloc," in the American political phrase, "the farm bloc," is an example. Another is the word "entrepreneur" in economics, meaning one who directs an industrial enterprise, as distinguished from those who contribute only capital or labor. As the cognate form, "enterprise," suggests, the entrepreneur is one who undertakes, or, in one word, an *undertaker*. It is interesting to note in passing that in an earlier period of the language it was possible to speak of more than one kind of "undertaker," whereas the one we immediately think of to-day was designated as a "funeral undertaker." He now has the term all to himself, unless, perchance, he decides to drop it and to adopt the French-Latin word "mortician."

Space does not permit even a bird's-eye view of the numerous borrowings that the English vocabulary has made from other foreign sources. Words like "zinc" and "kindergarten" from the German, "skipper" and "yacht" from the Dutch, "siesta" and "matador" from the Spanish, "thug"

and "bungalow" from the Hindi—these are only suggestions, which may be pursued indefinitely.

For his own satisfaction the student will doubtless wish to do some reading on the subject of words, their origin and history. Besides H. W. Fowler's *Dictionary of Modern English Usage*, a work which he will want to consult frequently, three books in particular are recommended for reading. They are: *Words and their Ways in English Speech*, by Professors James B. Greenough and George L. Kittredge of Harvard University; *Modern English, Its Growth and Present Use*, by Professor George Philip Krapp, of Columbia University; and *English Words and Their Background*, by George H. McKnight, of the Ohio State University. All of these informing books are readable and enjoyable.

ENLARGING ONE'S WORKING VOCABULARY

Increasing one's accuracy in the use of language calls for both the addition of new words and the cultivation of a closer acquaintance with those that are already partially known. As a means of stimulating the growth of a vocabulary, hunting expeditions in the dictionary are sometimes recommended, with the stipulation that a minimum number of words shall be collected each week or month. Although this is not the best means of obtaining a larger working vocabulary, there is undoubtedly much benefit to be gained from the practice of browsing in the dictionary. Its chief disadvantage is that the words and information which it yields are miscellaneous and unrelated. The natural way for one to acquire a word is through its context, and not as a detached specimen. Reference to the dictionary is very important, but it logically follows rather than precedes the acquisition of a word. What the dictionary tells about the origin and the history of a word becomes more significant in

the light of associations which the word is already known to have.

The soundest method of acquiring new words and of learning the finer distinctions between comparatively familiar ones is by observant reading of the works of careful writers. In this way words are discovered in contexts which form their natural setting—which explain them and are explained by them. Suppose, for example, that one is reading a passage in English history and comes upon the sentence, "Angered by Burleigh's contumacious reply, Queen Elizabeth dismissed him from her presence." Even if it is assumed, for the sake of the illustration, that "contumacious" is an entirely unfamiliar word, there is much in the context to explain it. It is evident, for example, that it describes an offensive manner of speaking. When the general notion of its meaning has been clarified and sharpened by the aid of a dictionary, the word will still be remembered chiefly in terms of its associations.

Usually, what is gained from a context is not a new word but a new appreciation of the shades of meaning of a familiar one. In a recent issue of a magazine that is well known for its high editorial standards is an article dealing with the relations between the civilized and the backward countries. Speaking of so-called "imperialistic ventures" from the point of view of the civilized nations, the author says:

Of the numerous annexations and other extensions of control which have marked the recent phenomenal expansion of Europe, scarcely one has been made *gratuitously* or even *voluntarily*.

Here is an important distinction nicely drawn between two synonyms. Use of the word *gratuitously*, would imply that the initiative had been taken by the stronger nation and that its action was uncalled-for. If the word were *voluntarily* it would indicate merely willingness, or consent. By

excluding both of these, the writer emphasizes the idea of reluctant yielding to pressure exerted from without.

Such distinctions are the result, not of hair-splitting or quibbling, but of close thinking. If works of this quality are read frequently and attentively the result will be a marked growth in the reader's collection of words, and, what is more important, in his ability to use the words appropriately and with discrimination.

In any group of students the individual members will be found to differ widely in the scope and character of their working vocabularies. Although many words are common to all, there are some ordinary expressions which one or another does not use.³ Moreover, if the class reads intensively a well-written article or essay, it will usually be found that some very serviceable words adapted to everyday use are not employed by any one in the group. As a suggestion for a list of new words acquired in this way, the following vocabulary list is appended. These words, which are not technical or foreign or impossible, were accumulated by members of one class during the reading of articles and stories in a single issue of a magazine. It is recommended that each student check off the words in this list which are new to him, or which, are not in his working vocabulary.

acrid
alembic
altruistic
amenable
analogous
animosity
atavistic
austerity
banal
blatant
casuistry

cavil
censorious
cogent
communal
consummate (*adj.*)
contiguous
crucial
cynical
decadence
delete
deplete

³ See George Herbert Palmer, *Self-Cultivation in English*.

dénouement	naïve
dereliction	niggardly
derogatory	nomenclature
dilemma	opulent
dogma	ostensibly
drastic	ostentatious
empirical	parlance
erudite	pathological
epigram	patois
exotic	peremptory
extant	perspicacity
façade	poignant
fatuous	potential
fetich	predatory
fiat	prolix
figment	propinquity
flaunt	psychiatrist
foist	recondite
fortuitous	relevant
heterogeneous	seismograph
implacable	shibboleth
importunity	smug
impunity	solecism
incognito	spoliation
indigenous	stigma
ineptitude	suave
inhere	sumptuary
inhibit	talisman
innate	tautology
innovation	transcendental
intrinsic	transient
inveterate	transitory
invidious	truculent
laconic	ubiquitous
layman	unobtrusive
maladroit	untrammelled
millennium	utopian
mulct	vacillate
mural	vicarious

DEFINITION AS A TEST OF ACCURACY

Because of its purpose and its form, the definition is an ideal brief exercise in the choice of words. Its purpose is to state the meaning so clearly that the term defined cannot be confused with its nearest synonym. Its form compels the writer to be definite and concise in his phrasing.

The typical, or "logical," definition, it will be remembered, consists of three parts, the term, the genus, and the differentia, which may be illustrated as follows:

TERM	GENUS	DIFFERENTIA
A <i>square</i> is a	<i>plane figure</i>	bounded by four equal sides and having four right angles.
or		
A <i>square</i> is a	<i>rectangle</i>	having equal sides.

The reason why definitions in science are regularly phrased in this way is not that some one has secured the adoption of an arbitrary form. It is that this form represents the obvious order in which the parts of the statement should be arranged: first, the term defined; second, the class, or genus, to which it belongs; and third, the special characteristics which distinguish it from other members of the general class. Compare the following example of a somewhat more complex definition:

Ductility is that property of certain solid bodies by virtue of which they may be extended by drawing into wire with corresponding diminution of diameter and without fracture or separation of parts.

A definition may or may not be accurate, but if it is put in the regulation form its validity can easily be tested. Even though the correctness of a definition may not always be susceptible of mathematical demonstration, the fact that its form is clear and complete insures an intelligent difference

of opinion, since it makes possible between the disputants what lawyers call a "meeting of minds."

In fact, the logical definition form, because of its directness, its brevity, and its insistence upon essentials, is greatly needed in the discussion of subjects which do not lend themselves to mathematical demonstration. The danger of vagueness increases in proportion as one departs from the field of exact science, but many concepts may be made clearer by logical definition of terms. Note, for example, how the following definition of an abstract word is expressed in the logical definition form:

Individualism is that social philosophy which emphasizes personality and places a premium upon initiative.

Another abstract term which is often loosely used is here explained in two definitions, the first by Agnes Repplier, the well-known American essayist, and the second by President A. Lawrence Lowell, of Harvard University:

a. Culture is that common understanding of the world's best traditions which enables us to meet one another with mental ease.⁴

b. Culture, therefore, does not mean the possession of a body of knowledge common to all educated men, for there is no such thing to-day. It denotes rather an attitude of mind than a specific amount of information. It implies enjoyment of things the world has agreed are beautiful; interest in the knowledge that mankind has found valuable; comprehension of the principles that the race has accepted as true. All this involves a desire to know coupled with a capacity to acquire, and appreciate.⁵

A writer may wish to express a contrast between two widely different terms for the purpose of emphasizing their dissimilarity. The result is at least an implied definition

⁴ *Americans and Others*, p. 104.

⁵ *North American Review*, 202: 555, Oct., 1915.

of each, with all the essential characteristics of the logical definition form, as in the following extract from a "Credo" signed by fifteen eminent scientists:

The purpose of science is to develop, without prejudice or preconception of any kind, a knowledge of the facts, the laws, and the processes of nature. The even more important task of religion, on the other hand, is to develop the conscience, the ideals, and the aspirations of mankind. Each of these two activities represents a deep and vital function of the soul of man, and both are necessary for the life, the progress, and the happiness of the human race.⁶

As an exercise in composition, the practice of making definitions cannot be too strongly recommended. By this means the student may learn whether he really knows the word to be defined and the words to be used in defining it. He may acquire skill in the direct, concise presentation of an idea, and may thus improve his discrimination in the use of words. At the same time, he may cultivate the habit of accuracy, not only in his choice of language but in his thinking as well.

⁶ Quoted by Henry Fairfield Osborn in the article, "Credo of a Naturalist," *Forum*, April, 1925.

CHAPTER VII

APPROPRIATE STYLE

THE general quality and the total effect of a piece of writing may be measured in terms of its style. That this is true of literary composition is universally recognized. The importance of style in technical writing, however, is frequently discounted or ignored. A great deal depends, of course, on one's definition of terms. If style is regarded as elaborate literary ornament, consciously added to plain language, the technical student is justified in viewing it with distrust. Likewise, if technical English is understood to be the uniformly colorless, conventional sort of prose that is sometimes found in engineering reports, then the less said about its style the better.

As a matter of fact, there are many kinds and qualities of technical writing, and they illustrate many varieties of style. Moreover, the word "style" can be interpreted in almost innumerable ways. Definitions of it range from the strictly personal notion of style as a characterization of the individual writer to the purely objective sense, in which it refers to the classification of the works themselves. We may speak broadly of the "literary" style, which emphasizes imagination and artistic taste, as contrasted with the scientific style, which emphasizes logic and the sense of fact. We may speak of "colloquial" style, which has the brevity and informality of ordinary conversation, as contrasted with "written" style, which has greater dignity, precision, and completeness. We may recognize degrees of style within the same general class; for example, "technical

style," which is written by and for specialists; "semi-technical style," which is addressed to educated persons who are without expert knowledge of the subject; and "non-technical," or "popular scientific style," which is intended to interest the general reader by translating the facts of science into terms of his limited experience. Approaching the subject from a different angle, we may speak of the qualities of style, such as clearness, vigor, or conciseness.

Because of the almost bewildering variety of ways in which the subject may be considered, the student should not depend upon specific, hard-and-fast rules, but should be guided in his practice by general principles, typical examples, and his own sense of proportion. In revising manuscripts, he will find use for detailed classifications and specific labels; but, when he begins to write, he should not be too conscious of critical terms. It is hardly conceivable, for example, that a person who is about to write should say to himself: "Go to, now, I will produce an example of semi-technical style." The natural and obvious thing for him to do is to think of his subject, his readers, and his purpose, and to shape his language accordingly. The test which he first applies to his work is the question, "Have I accomplished my purpose?" If this question cannot be answered satisfactorily, it is time for him to analyze the details of expression.

The most important general principle in technical writing is that the style should be unobtrusive; that is, that it should not attract attention to itself or to the writer. Stated positively, the requirement is that the reader's attention should be kept exclusively on the subject matter. If the style is at its best, it is as though the writer were looking through a perfectly clear lens, and were conscious only of the object and not at all of the transparent medium. Some persons who recognize this requirement in theory

assume that because the subject is the all-important thing, the writer need pay no attention to the style in which his ideas are expressed. The very opposite is true. In order that the reader may be compelled to think exclusively of the subject, the writer must take special pains to state his ideas clearly and to avoid any turn of phrase that might cause the reader's attention to wander.

It may be suggested that a uniformly colorless style would be the safest for the writer to adopt, on the theory that, having no distinctiveness of its own, it could not compete with the subject matter for the reader's notice. For at least two reasons, this view is unsound. In the first place, the reader soon becomes unpleasantly conscious of repetition or sameness, and begins to think about that rather than about the subject. Or, if it is a smooth-flowing monotony, he soon falls asleep and thus loses contact with the subject entirely. Consistency is a virtue, but no reader can be expected to enjoy consistent mediocrity or dullness. A still more serious objection to colorless style is that it precludes the possibility of emphasis; and any writer who thinks vigorously must constantly introduce varying shades of emphasis. In this sense, any good piece of writing has individuality, even though it be expressed in the approved third person and passive voice characteristic of technical style. Even when the grammatical form is impersonal, the writer's personality is revealed in proportion as his composition results from first-hand observation and original thinking. It is this fact, and not any artificial effort to secure variety, that makes good writing free from colorless monotony.

As a means of insuring the clarity and vigor which good style should have, the writer's language should be specific and concise. General and evasive expressions, such as "very large," "to a certain extent," or "to a considerable degree," should be carefully avoided, or rather, the mental attitude

which produces them should be avoided. Any one who undertakes to write on a technical subject should have the accurate knowledge which leads to definite, concrete expression.

A general principle that has already been suggested is that the style of a piece of writing should be adapted to the reader and to the purpose for which the composition is intended. It will be recalled that this principle was followed in the classification of the style of technical writing into three general types: technical, semi-technical, and non-technical. This separation may appear somewhat arbitrary, in view of the fact that the three kinds often shade over into one another and may all be represented in a single article. Although many gradations could be recognized between the extreme forms, a threefold classification will be found useful because it emphasizes outstanding differences in the groups of readers for whom technical compositions may be prepared.

Technical style. Within the narrow circle of the initiated, expressions may be intelligible which outsiders would find as puzzling as a code message. Witness the following example of a report submitted by the superintendent in charge of a bridge construction project:

A traveler was on the lower cord of the approach span of the Williamsburgh Bridge, and was sustained by four guys. Each guy was held fast by two dogs, after passing through an opening in the tailpiece. Tony, an Italian, had just been sent over and had given two of the dogs a fresh bite on the longest guy, when they were let loose, one of the guys slipped, and the traveler tipped over, threw the counter-weights into the air, and they fell down on the street below and killed a man.

In the last few words, the general reader learns that this is a report of a fatal accident, but the details are beyond him. The shop terms of bridge construction doubtless have a

meaning for him, but it is very different from the technical one.

Another example of communication between specialists is the following:

Where

$$L' = T - V$$

T is a homogeneous quadratic function of the velocities y , being that part of the total energy which is due to the motions corresponding to the degrees of freedom specified by the y co-ordinates, and V is a function of the y co-ordinates which is equal to that part of the total energy which is due to the motions corresponding to the degrees of freedom whose co-ordinates have been eliminated. From this follows the possibility of the existence of a class of motions whose complete history can be determined from a knowledge of one function, this function being a modified Lagrangian function. An example of this class of motions is furnished by the mechanics of a conservative system of rigid bodies, the kinetic energy of the system being the function denoted above by T and the potential energy the function denoted by V . The Lagrangian function of the motion is $T - V$ and from the above $T + V$ is constant, being equal to the Lagrangian function which is expressed in terms of all the degrees of freedom. On this view, then, potential energy is the energy of what may be termed the concealed motions—that is, the energy of those motions which correspond to degrees of freedom which are not directly observed.

The secret regarding the Lagrangian function is safe from all but a few initiated readers.

No objection can be made to technical terms, as such. They are precise, and in certain contexts they are not only appropriate but indispensable. They are very economical of space, because every one of them is equivalent to a long definition and a whole background of associations. If the context in which they occur has the vigor and clearness which belongs no less to technical than to other kinds of writing, it is good style. The only question is whether it is appropriate to the reader.

Semi-technical style. For a variety of practical purposes, the technical man is often compelled to translate the facts of science into language that can be understood by persons who do not share his background of specialized knowledge. To do this successfully is more difficult than to write good technical style, because it requires adaptation. The writer must not only have greater flexibility of expression; he must have a more thorough knowledge of the subject. Huxley demonstrated the value of this twofold preparation in his *Lay Sermons* on the Darwinian theory. Of course there are degrees of difficulty, ranging all the way from the explanation of a comparatively simple phenomenon like corrosion, to the elucidation of radio, or evolution, or the Einstein theory of relativity. Whatever the subject, the writer must be very much at home in it before he can venture to explain it to an audience of laymen. Even if he were not obliged to do it as a matter of practical necessity in his professional work, he would find it worth doing as an exercise, in order to test his knowledge.

A typical example of semi-technical style is the following passage quoted from Francis E. Leupp's *Life of George Westinghouse*. One of the most interesting of the many exciting episodes in the career of Mr. Westinghouse was the so-called "Contest of the Currents," or the battle between the direct-current system and the newer alternating-current system of supplying electricity for use. In order to prepare his lay reader to appreciate the story of this episode, Mr. Leupp includes this paragraph of explanation:

For the reader's better understanding, it may be said that a direct or continuous current is comparable to water made to flow through a pipe always in one direction, whereas an alternating current is as if the same water were made to flow through the pipe first in one direction and then in the other, the reversals of direction occurring a great many times in a single second—an expedition

which would be possible only in so imponderable an essence as electricity. The result to the user of electricity is practically the same with either system, except in the matter of cost. With the direct system, it is necessary to generate and distribute the current at a pressure, or voltage, that will not burn out the filament of incandescent lamps. As this pressure is relatively very low, and the quantity of electricity that can be conveyed by wires is dependent upon the pressure at which it is being distributed, the cost of the conducting wires, constituting a large part of the investment in an electric production and distribution system, is greatly increased as compared with the alternating system; in the latter, very high electrical pressures can be employed, with a proportionate reduction in the cost of the distributing wires, and then, by simple and cheap mechanisms, transformed or converted to the required low pressures at the point of use.

The use of semi-technical style is not confined to writings on applied science but is very common in articles written in the field of pure science. Most engineering periodicals follow what may be called a "standard" semi-technical style, which aims at clearness for the reader whose knowledge is not too highly specialized. Instructions, reports, and other engineering communications intended for strictly practical uses are similarly free from technical language which might puzzle some of their readers.

Non-technical, or popular scientific style. Not infrequently, a person who has some form of specialized knowledge must meet his reader more than half way. He must not only explain the subject, but must also enliven it. His problem of adaptation is especially difficult, since he must impart elementary information without explicitly recognizing the reader's probable ignorance. It is a question of diplomatic phrasing. By means of comparisons, allusions, reminders, and parenthetical explanations, a skilled writer is able to refer to many facts which he dare not take for granted, and at the same time to pay the reader the compliment of assumed familiarity with the subject.

The book *Creative Chemistry*, by the late Dr. Edwin E. Slosson is written in a popular scientific style that has distinctly literary quality. Here is a brief extract quoted from the chapter on "Nitrogen—Preserver and Destroyer of Life."

NITROGEN PRESERVER AND DESTROYER OF LIFE

A striking statement like the opening sentence commands the reader's attention.

Note the kaleidoscopic review of human progress in methods of warfare. It suggests a rapid summary of H. G. Wells's Outline of History.

There is both scientific accuracy and literary interest in the whimsical references to cellulose and silica.

Here the author introduces allusively some historical facts which the reader has probably forgotten, if he ever knew them.

An indirect, and therefore, literary way of conveying the elementary information that gunpowder is made of three chemical constituents.

More history, with a suggestion of racial traits.

Here is a very apt literary allusion. Read the first part of Shakespeare's Henry IV, Act I, Sc. 3, to learn why Hotspur was furious at the messenger who spoke of "villainous saltpetre."

A bit of historical philosophy is here emphasized which was already suggested in the Shakespeare allusion.

Note the picturesque elaboration of the idea that the beginning of gunpowder warfare was the end of Knighthood.

In the eyes of the chemist the Great War was essentially a series of explosive reactions resulting in the liberation of nitrogen. Nothing like it has been seen in any previous wars. The first battles were fought with cellulose, mostly in the form of clubs. The next were fought with silica, mostly in the form of flint arrowheads and spear-points. Then came the metals, bronze to begin with and later iron. The nitrogenous era in warfare began when Friar Roger Bacon or Friar Schwartz—whichever it was—ground together in his mortar saltpeter, charcoal, and sulfur. The Chinese, to be sure, had invented gunpowder long before, but they—poor innocents—did not know of anything worse to do with it than to make it into firecrackers. With the introduction of "villainous saltpeter" war ceased to be the vocation of the nobleman and since the nobleman had no other vocation he began to become extinct. A bullet fired from a mile away is no respecter of persons. It is just as likely to kill a knight as a peasant, and a brave man as a coward. You cannot fence with a cannon ball nor overawe it with a plumed hat. The only thing you can do is to hide and shoot back. Now

Don't overlook the Biblical allusion.

you cannot hide if you send up a column of smoke by day and a pillar of fire by night—the most conspicuous of signals—every time you shoot. So the next step was the invention of a smokeless powder. In this the oxygen necessary for the combustion is already in such close combination with its fuel, the carbon and hydrogen, that no black particles of carbon can get away unburnt. In the old-fashioned gunpowder the oxygen necessary for the combustion of the carbon and sulfur was in a separate package, in the molecule of potassium nitrate, and however finely the mixture was ground, some of the atoms, in the excitement of the explosion, failed to find their proper partners at the moment of dispersal.

More information about the chemistry of gunpowder is here presented in suggestive rather than directly instructional form.

The new gunpowder besides being smokeless is ashless. There is no black sticky mass of potassium salts left to foul the gun barrel.

This passage, brief as it is, illustrates a remarkable variety of style. Ideas, images, facts, and allusions follow one another in rapid succession. Even whimsical conceits and a touch of philosophy are present. The style has the quality of unexpectedness, which the British novelist Galsworthy singles out as the chief attribute of literary writing. And yet the elements which compose this style are not laboriously assembled, but are held in solution in the writer's mind, to be applied readily wherever they are needed. The author draws on a rich background of literary and historical knowledge, but the basis of his discussion is a sound training in science. It should be remembered that this was the same Dr. Slosson who obtained his Ph.D. in chemistry, and who wrote a monograph on the sufficiently technical

subject of *Acylhalogenamine Derivatives and the Beckmann Rearrangement*.

Lest this example of popular scientific style should appear hopelessly difficult and so prove discouraging to those who lack Dr. Slosson's background, it should be pointed out that the technical writer may begin, at least, on a much lower level. Then he can work, by degrees, toward the versatility which will enable him to meet the requirements of any situation. He will find many occasions for practice. In preparing reports, articles, addresses, and sales matter, and in explaining technical projects to business men, he will have use for all the literary resourcefulness that he can command. Naturally, he will find that a sound technical knowledge will always be the essential starting point. The ability to present this knowledge in a variety of ways will come, not through direct imitation of some one else's style, but through the growth of his vocabulary and the enrichment of his own literary background.

DIAGRAMMATIC AND STATISTICAL STYLE

Perhaps the greatest general fault of technical writers is an attempt to use words for purposes that could better be served by drawings, curves, or tables of data. Inevitably, the result is a series of tedious repetitions. The engineer's characteristic passion for efficiency should save him from such superfluous language.

The illustrations of this fault that are given below have been made mercifully brief, but it is hoped that they are enough to warn the student against permitting statistical or diagrammatic style in his own writing. They may be identified almost at a glance by the prevalence of numerical expressions.

The plant in general covers a rectangular space 150 yards long and 120 yards wide, with its length extending from north to south.

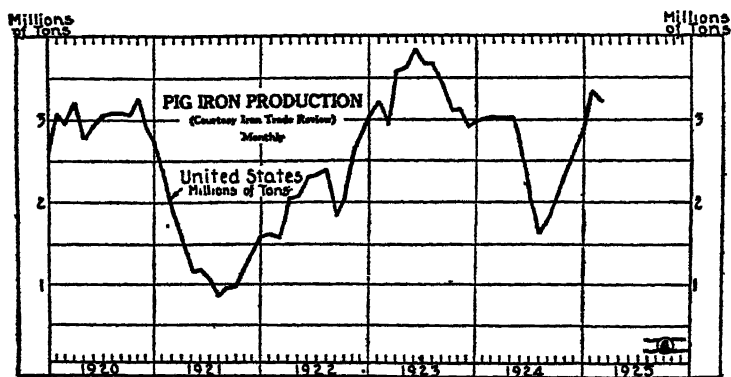
The rectangle is modified, however, by the addition of a smaller rectangle, which extends along the north end, starting in the north-east corner, and following the north side for a distance of 40 yards. This rectangle is 30 yards in width. In this area are the offices and laboratories. The large rectangle is further modified by a switch which enters the west side at a point 35 yards from the southwest corner, and runs diagonally . . .

Imagine a reader wading through page after page of solid text like that shown in the example above. For any one who follows the description conscientiously, the effort is a kind of psychological test. The average reader, however, would not follow it closely. He would turn away from it, not so much because of its difficulty as because of its inappropriateness. He would be annoyed to find that so complicated a form of expression had been used to convey ideas that could be presented clearly and simply by another method. A sketch would reveal at a glance all the facts about directions, proportions, and dimensions that could be stated in two or three pages of meticulous writing. And the energy saved by the use of the sketch could be expended with greater profit on the analysis of a real problem in descriptive geometry.

Usually, it is true, the sketch is accompanied by language, but the written part should merely supplement and interpret the drawing and should not put into words the information which has already been expressed more clearly in terms of lines and numerals. Except in such highly special documents as patent claims, there is practically no use for the kind of technical writing which consists of verbal diagrams.

The reader's objection to drawings expressed in words is at least equaled by his resentment of verbal tabulations. When he finds a column of figures masquerading as a series of sentences, he rightly feels that he is being swindled. He is particularly offended when he finds the writer using

words to express the relation between two sets of figures, or to trace changes in the relative status of a group of variables over a period of time. Such ideas cannot be fully conveyed by means of connected discourse, and any attempt to express them in language imposes an unnecessary strain on both the writer and the reader. Notice how the ideas in the following quotation concerning pig iron are expressed much more clearly and completely in the simple graph shown above it.



At the beginning of the year 1920, the monthly production of pig iron in the United States was a little more than 2,500,000 tons. In January of that year the total rose to a little more than 3,000,000 tons, and a slight falling off in February was succeeded by a rapid increase in March, which carried the total for that month to nearly 3,250,000 tons. In April, however, a sharp decline in production occurred, the total being about 2,700,000 tons. A steady increase now set in,—(and so on, up to February, 1925, in monthly instalments!)¹

The use of graphic methods of presenting data is so important in technical writing that a separate discussion of the subject is included in this book. (See pages 216-226.) Be-

¹ Doubtless the reader will notice the resemblance between this kind of writing and the so-called "hokum" that is sometimes used as space filler in market reports and elsewhere.

cause of its influence in condensing, clarifying, and vitalizing statistical data, graphic expression, even though it does not deal directly in words, may well be called a phase of style. Since it keeps the writer from using words where they do not belong, it is at least an indispensable aid to good writing.

ABSTRACT VERSUS CONCRETE STYLE

Unless he is dealing with metaphysical speculation, the technical writer can usually present his ideas in specific terms. The reader, upon seeing a general statement or an abstract word, instinctively asks, "For example?" If the example is not promptly supplied, the reader probably loses contact with the thought. Every one who writes should back up his general statements with specific illustrations, not only as an aid to the reader but also as a guarantee against vagueness in his own thinking. If he is writing semi-technical or popular scientific discussions, he may even find it worth while to have his examples precede and introduce the general statements.

The following passages illustrate in somewhat extreme form the contrast between the concrete, specific style and the abstract, general style.

A.

When you purchase from an agency representing, as ours does, a large manufacturing corporation, you get the benefit of all the achievements of modern science. All the resources that research can command are dedicated to your service. Laboratory tests insure the reliability of every product that ministers to your daily comfort and satisfaction. By drawing upon the largest reserve of technical brains and skill, you can open the way to a fuller enjoyment of life amid the luxuries which modern civilization affords.

B.

My friend Lorimer fairly revels in the pleasures which science has made possible for a pampered generation. He listens nightly

to a far-flung series of radio concerts spanning a continent. His breakfast is facilitated by the use of electric percolator and toaster. He drives daily to and from the office in an automobile that is fairly laden with accessories. These mechanical and electrical devices light his cigar, signal his intentions as to stop or direction of turning, notify him when the gasoline or oil supply is low, and warn him, of course, when his speed invites pursuit by a determined person on a motorcycle. Meanwhile, Lorimer, the god of the machine, sits enthroned on a plush seat which rests on scientifically designed springs, elastic enough to provide luxurious resilience and yet rigid enough to impart a feeling of security.

Until recently, Lorimer had never heard of a research laboratory.

The difference between these two examples is so striking that extended comment is unnecessary. The concrete style is characterized by active verbs, by specific nouns and adjectives—in a word, by pictures. The abstract style is vague and shadowy. If the first passage were continued, the only way in which the reader's interest could be held would be by the immediate mention of specific "luxuries which modern civilization affords." Perhaps it is already too late to regain the reader's attention, for the beginning is not encouraging. On the other hand, the writer of the second passage has earned the reader's consent to include some general statements concerning research.

ABBREVIATED STYLE

In the chapter on "Clear Statement of Ideas" it was pointed out that some writers allow the cryptic language of the notebook to influence the form of their sentences in regular connected discourse. A related, but more serious, fault is the use of a semi-authorized form of condensation which technical writers especially are inclined to adopt, namely, the creation of awkward and unnecessary compound expressions. For example, instead of saying "a tunnel 7 feet in diameter," a writer will put down "a 7-foot

tunnel." The compound form is not only awkward; it is incomplete, and therefore, inexact. Some time ago an indignant contributor to *The Atlantic Monthly* expressed his disapproval of this abbreviated kind of writing in a little essay ironically entitled "The Efficient Style." An extract from his outburst is quoted below.

THE EFFICIENT STYLE

As a result of the general passion for efficiency, an ancient and useful, though modest, member of the parts of speech is marked for the scrap-heap. Not by systematic propaganda, but by their practice, the efficiency experts have indicated their program of reform. Their goal, to express it in their own style, is *preposition elimination*, and their method is *compound formation*.

I am aware that the expressions just used are not remarkable, either for euphony or for perspicuity. The absence of these old-fashioned qualities, however, does not trouble the pragmatists of the efficient style. From their point of view, which for the moment I am trying to adopt, the highest good is *space utilization*. If a line to the page may be saved by the use of prepositionless phrases formed by *substantive juxtaposition*, who but a foe to conservation would oppose such plainly demonstrable economy? . . .

To be sure, the juggling of substantives might be somewhat awkward at first, but with a little practice the average writer could become as skillful as the makers of newspaper headlines. Let him learn wisdom from such puzzling but space-saving captions as "Wilson Opposition Increases," which he who runs is expected to read. Let him study the writings of technical men, who turn out such masterpieces of prepositionless style as, "*Motor car cost reduction and car selling system efficiency combine to produce an unparalleled car sales volume.*"

The student should test himself for this error by careful reading of his own manuscripts. If he finds a tendency toward prepositionless language, let him take warning from the sentence on *motor car cost reduction* as a horrible example of *space saving efficiency*.

JARGON

In some respects, the brusque incompleteness of abbreviated style is a less serious fault than one other: the use of expressions which have become chronically conventional. A certain amount of effort and even of ingenuity is required to coin a compound phrase, even though it be an awkward phrase. The writer who deals in conventional expressions can make no claim to originality, since he follows the proverbial line of least resistance. In doing so he inevitably produces bulky and colorless sentences.

In the volume *Suggestions to Authors* published by the United States Geological Survey (page 70), a striking parallel is drawn between the bulky, conventional form and the concise, original, and natural form of writing. Contrast the following pairs of sentences quoted from this source:

The fragments in a large number of cases show signs of glaciation.	Many of the fragments show clear signs of glaciation.
--	---

In some instances a connection is maintained with the ocean by narrow channels.	Some of the bays are still connected with the ocean by narrow channels.
---	---

In the great majority of cases where coal exists but has not been found to be workable it lacks one of three things—either quality, thickness, or accessibility.	Most unworkable coals are deficient in quality, thickness, or accessibility.
--	--

In the case of malacone the formula proposed is not absolutely certain.	The formula proposed for malacone is not absolutely certain.
---	--

As in the case of oil lands, phosphate lands are withdrawn.	Phosphate lands, like oil lands, are withdrawn. . . .
---	---

The sentences in the left-hand column are bulky, vague, conventional, and lifeless. Those on the right are by com-

parison clear, direct, and concise. The change is brought about by the omission of such almost meaningless phrases as "in a large number of cases," "in some instances," and so on. The most significant thing about these phrases is that they are symptoms of a rhetorical disease, the use of *jargon*. Technical and scientific writers are by no means the only persons who are thus afflicted; the disease is common among all writers of routine communications. By far the best statement of its diagnosis and cure is that given by Sir Arthur Quiller-Couch, Professor of English Literature at Cambridge University, Cambridge, England, in his book *On the Art of Writing*.² His discussion contains so valuable a combination of inspiration and common sense that a quotation from it seems indispensable in a chapter on "Style." Any one who reads the following passage closely will obtain constructive suggestions and a critical point of view that will be directly helpful in the revision of his own compositions.

It [Jargon] looks precise, but is not. It is, in these times, *safe*: a thousand men have said it before and not one to your knowledge had been prosecuted for it. . . .

Has a Minister to say 'No' in the House of Commons? Some men are constitutionally incapable of saying no; but the Minister conveys it thus: 'The answer to the question is in the negative.' That means 'no.' Can you discover it to mean anything less, or anything more except that the speaker is a pompous person?—which was no part of the information demanded.

That is Jargon, and it happens to be accurate. But as a rule Jargon is by no means accurate, its method being to walk circumspectly around its target; and its faith, that having done so it has either hit the bull's-eye or at least achieved something equivalent, and safer.

Thus the clerk of a Board of Guardians will minute that—

'In the case of John Jenkins deceased the coffin provided was of the usual character.'

Now this is not accurate. 'In the case of John Jenkins deceased,' for whom a coffin was supplied, it is wholly superfluous to tell us

²Published by G. P. Putnam's Sons, New York. Used by permission.

that he is deceased. But actually John Jenkins never had more than one case, and that was the coffin. The clerk says he had two,—a coffin in a case; but I suspect the clerk to be mistaken, and I am sure he errs in telling us that the coffin was of the usual character; for coffins have no character, usual or unusual. . . .

Have you begun to detect the two main vices of Jargon? The first is that it uses circumlocution rather than short straight speech. It says: 'In the case of John Jenkins deceased, the coffin' when it means 'John Jenkins's coffin'; and its yea is not yea, neither is its nay nay; but its answer is in the affirmative or in the negative, as the foolish and superfluous 'case' may be. The second vice is that it habitually chooses vague woolly abstract nouns rather than concrete ones. . . .

Since these lectures are meant to be a course in First Aid to writing, I will content myself with one or two extremely rough rules; yet I shall be disappointed if you do not find them serviceable.

The first is: Whenever in your reading you come across one of these words, *case*, *instance*, *character*, *nature*, *condition*, *persuasion*, *degree*—whenever in writing your pen betrays you to one or another of them—pull yourself up and take thought. If it be 'case' (I choose it as Jargon's dearest child—'in Heaven yclept Metonymy') turn to the dictionary, if you will, and seek out what meaning can be derived from *casus*, its Latin ancestor; then try how, with a little trouble, you can extricate yourself from that case. The odds are, you will feel like a butterfly who has discarded his chrysalis.

Next, having trained yourself to keep a lookout for these worst offenders (and you will be surprised to find how quickly you get into the way of it), proceed to push your suspicions out among the whole cloudy host of abstract terms. 'How excellent a thing is sleep,' sighed Sancho Panza; 'it wraps a man round like a cloak'—an excellent example, by the way, of how to say a thing concretely; a Jargoneer would have said that 'among the beneficent qualities of sleep its capacity for withdrawing the human consciousness from the contemplation of immediate circumstances may perhaps be accounted not the least remarkable.' How vile a thing—shall we say?—is the abstract noun! It wraps a man's thoughts round like cotton wool. . . .

A lesson about writing your language may go deeper than lan-

guage; for language (as in a former lecture I tried to preach to you) is your reason, your λόγος. So long as you prefer abstract words, which express other men's summarised concepts of things, to concrete ones which lie as near as can be reached to things themselves and are the first-hand material for your thoughts, you will remain, at the best, writers at second-hand. If your language be jargon, your intellect, if not your whole character, will almost certainly correspond. Where your mind should go straight, it will dodge: the difficulties it should approach with a fair front and grip with a firm hand it will be seeking to evade or circumvent. For the style is the man, and where a man's treasure is there his heart, and his brain, and writing, will be also.

Criticism of one's own style is not easy, for it requires unbiased judgment and a detached point of view. A writer may be unconscious of mannerisms which are perfectly clear to others. Whether the trouble is an individual habit of expression, such as the repetition of a pet phrase, or a common offence, such as jargon, he may fail to recognize it until some one brings it forcibly to his notice. Then, having once identified the fault, he should be able to guard against it for the future. By learning to test his work from the standpoint of some one else, he may gradually eliminate the peculiarities of style which draw the reader's attention to the form and away from the thought.

After the objectionable features of his style have been removed there remains the question of its fitness, as judged by the writer's purpose. The positive qualities needed in good expression are summed up in the single requirement of appropriateness. For every piece of writing, including the least pretentious kinds, there is a proper and suitable style. At the same time, of course, there are many variations from the standard. In determining the general type of expression to be used in a given case, the writer is guided by his sense of proportion. In shaping the details so that they will best accomplish his purpose, he draws upon the sum total of his literary observation and experience.

CHAPTER VIII

REVISION OF MANUSCRIPTS

Learning to write is largely a question of learning to re-write. The student may know theoretically all the requirements for an acceptable manuscript and may still be unable to meet those requirements in his own written work. To gain a practical knowledge of composition, he must experiment repeatedly. He may depend for a time upon suggestions offered by others, but sooner or later he must revise his manuscripts without assistance. On reaching this stage in his development he will not only enjoy a feeling of literary independence; he will be in a position to make sure that his work is effective.

Practice in writing, of course, will cut down the amount of revision necessary. By close attention to details the student can learn to write offhand a composition that is mechanically and grammatically correct. The object of his elementary course in English is to develop his ability to do this. His characteristic faults are best revealed through the writing of impromptu compositions and, of course, are best remedied through the revision of manuscripts. In the more advanced stages of his training, clearness and correctness may usually be taken for granted. His attention may then be given to adding interest, variety, smoothness, and other qualities which make writing effective.

The quality of a manuscript is naturally influenced by a number of considerations, of which time is one of the most important. Until the student has had a great deal of practice, the speed at which he writes may account for most

of his mechanical and grammatical errors. Later, he will be able to put down a correct expression as rapidly as an incorrect one. Then, too, he will write more fluently and more clearly in proportion as he knows his subject and is interested in it. Indeed, he should not attempt to write until he does know it. Given a definite purpose and a proper understanding of his material, he can write with vigor and with logical directness. His composition can thus be struck off at white heat, as a good piece of writing should be. The energy of the original version can be preserved and even enhanced by the revising process which comes after the manuscript has been laid aside to cool.

Every composition—and, for that matter, every writer—is so much an individual problem that no scheme for the criticism and revision of manuscripts can be made universally applicable. Neither will any set of critical terms or symbols be found that is all-inclusive. In a fifteen-minute conference with an instructor details will be brought out which no list could anticipate and which no amount of discussion would be certain to include. Perhaps the best that can be done within a relatively brief space is to give an outline of the common points to be considered and an illustration of some of the principal faults, with the symbols and comments used in correcting them. In revisions which aim at greater effectiveness, it will be observed, there is less use for specific correction marks and more for general criticism. The working over of such passages is chiefly a matter of experimenting with phrases, and it probably ends in a search for the right word.

In the whole process of revision by far the most important requirement is that of elasticity—of willingness to experiment, combined with ingenuity in the discovery of new ways of saying things. Every writer has a perpetual struggle with his own reluctance to make sweeping changes.

He must not only muster up sufficient energy to frame the new expression; he must also overcome an obsession which may be called "the sanctity of the original version." Just as some people who see a thing in print are inclined to accept it as correct, merely because it stands in type, the average writer is inclined to be prejudiced in favor of the visible form which has been given to a unit of composition. "How else," he inquires, "could the thing be said?" Let him be answered in Kipling's words:

There are nine and sixty ways
of constructing tribal lays,
And every single one of them is right.

Obviously, though, some forms are preferable to others. The danger is that a poor one may crowd out the others through no claim except priority. Instead of encouraging this kind of literary primogeniture, the writer will do well to regard every first draft as a doubtful claimant.

For the sake of brevity, the principle may best be illustrated in terms of a sentence. Suppose that the first form is an especially faulty one, with a minimum of sanctity:

It makes it more convenient to handle the heavy equipment
if they use traveling cranes.

Following a practice common in such cases, the writer may begin by timid and tentative efforts to patch up a word or phrase without disturbing the general plan. Such revision will get him nowhere. Owing to the "it" construction, the sentence is fundamentally bad; therefore, let him feel free to toss the whole statement on the scrap heap. Then he will be unhampered in devising a new expression for the central idea; for example:

The heavy equipment can be handled more conveniently by
means of traveling cranes.

or, better still,

The use of traveling cranes facilitates the handling of the heavy equipment."

These are only two of many possible substitute forms. One test of a writer's all-round ability is the number of different versions which he can propose for the expression of the same thought. Whether the unit to be revised is a sentence, a paragraph, or an entire composition, the writer should be able to treat it with a maximum of elasticity. He should always be ready, if necessary, to discard the first form entirely.

How extensively a writer may revise his compositions depends mainly on his own literary conscience. If he is unwilling to regard a manuscript as a final draft until he has reshaped it completely and repeatedly, his ability to write will develop in direct proportion to his efforts. The reader, too, will benefit from such careful revision. Sheridan's couplet, although referring more particularly to literary efforts, applies equally well to the most practical kinds of writing:

You write with ease to show your breeding;
But easy writing's curst hard reading.

SYMBOLS FOR THE CORRECTION OF MANUSCRIPTS

The following symbols, most of which are in general use, represent a code which will be found convenient in identifying specific mistakes. Whether this particular code or some other is adopted, the important thing is that the student should clearly understand the meaning of the symbols and abbreviations. By reference to pages 170-183 the student will find illustrations of the principal faults which the symbols represent. In general, the grouping of typical errors corresponds to the chapter plan of the text.

SYMBOLS AND ABBREVIATIONS USED
IN CORRECTING MANUSCRIPTS

(Those below the rule are also used in proofreading.)

Abbr.	abbreviation
Cl.	clearness
Con.	connection
E.	emphasis
G.	grammar
Id.	idiom
In.	indent
K.	awkward
Log.	logical inconsistency
Ms.	manuscript
O.	omit
p.	punctuation
Ref.	reference
Rep.	repetition
Sm.	smoothness
Sp.	spelling
Sub.	subordination
U.	unity
W.W.	wrong word
x.	obvious error

Caps.	capital letters
l. c.	lower case, or small letters
✂.	delete, or take out
Stet.	let it stand
○.	close up
#.	insert space
∧.	insert
tr.	transpose
¶.	begin a new paragraph
No ¶.	combine with the preceding paragraph

Typical uses of these abbreviations are shown in the corrected compositions on pages 170 to 183. Detailed explanation and illustration of the principal faults in writing will be found on these same pages and in the Appendix.

The discussion quoted below and on the following left-hand pages is an illustration of fair material with very faulty details of expression. The symbols listed on page 169 are used repeatedly in this passage.

A.

THE MANUFACTURE OF SULPHURIC ACID

- Sub.* There are many chemical compounds that play their role for the benefit of humanity,
- E.* and one especially, sulphuric acid, seems to take the lead. The Jarecki Chemical Company employs it for two of the most important benefactors of life: fertilizer and alum.
- W.W.* Fertilizer to enrich our soil and give us more and better food. Alum to purify the water we drink and to finish the paper we read. Just for these few daily necessities
- G. No verb* *Id.* we see that sulphuric acid is a dear friend instead of the malicious chemical most of us picture it. Let us proceed to see how it is utilized at the Jarecki Chemical Company for our purposes.
- W.W. Style* *Bulky phrasing* *Log.* *Log.* The Jarecki Chemical Company is located at St. Bernard, on the B. & O. railroad.
- W.W. / I.C.* The outlay of the fertilizer plant, Alum plant, sulphuric acid plant, power house, office, and sundry buildings covers seven acres. Since fertilizer and alum are made by the reaction of sulphuric acid and other substances, it is but natural to explain first the process of manufacture. The Jarecki Chemical company uses the chamber process to make sulphuric acid. It will be seen that this process is a complicated one and necessitates careful and expensive supervision and management.
- Sm.* Sulphuric acid is made from brimstone,

The following passage is a revised draft of the selection beginning on page 170, with the detail errors corrected. Further revision of the second passage is suggested in the notes which accompany the text.

A'

THE MANUFACTURE OF SULPHURIC ACID

The first sentence is improved in conciseness and emphasis.

"The Jarecki Chemical Company" is abruptly introduced and is mentioned in connection with the use, rather than the manufacture, of sulphuric acid.

The third sentence contains elementary information, which may be taken for granted or recalled incidentally instead of being explicitly stated.

Omit "our," line 9. "Essential" as a noun is not good.

"Dangerous" is much better than "malicious," of the original draft: The logical relationship between "dangerous" and "useful" hardly justifies the "although" pattern.

"Together with" (line 21) is misleading, or at best ambiguous. The idea is, rather, "besides a separate group of buildings used for office, storage, and service purposes."

Sulphuric acid is among the foremost 1
of the many chemical compounds that 2
benefit humanity. The Jarecki Chemical 3
Company employs this acid for the prep- 4
aration of two substances which are im- 5
portant to mankind, fertilizer and alum. 6
Soil enriched by fertilizer gives larger 7
and better food crops. Alum is a puri- 8
fying agent for our drinking water and 9
is an essential in paper manufacture. 10
Therefore, although sulphuric acid is the 11
dangerous chemical most of us consider 12
it to be, it is useful in the preparation of 13
at least two of the necessities of modern 14
life. 15

The Jarecki Chemical factory, which 16
is located in St. Bernard on the B. & O. 17
railroad, covers an area of seven acres 18
and includes an alum plant, a fertilizer 19
plant, a sulphuric acid plant, and a power 20
house, together with several buildings 21
for office, storage and service purposes. 22

Since fertilizer and alum are produced 23
by the reaction of sulphuric acid with 24
other substances, the manufacture of this 25
acid is the most important work carried 26
on at the factory. The Jarecki Chemi- 27
cal Company uses the chamber process 28
to make sulphuric acid. It will be seen 29
that this process is a complicated one 30

p. cl. nitrate of soda, water and oxygen derived
p. from the air. The brimstone which is
Abbr./p. about 98% pure sulphur is obtained from
 Texas.

No p. Nitrate of soda is obtained from Chile
U. or Sub. and is 95% pure. It is used simply as an
Sp. oxygen carrier.

No p. Water is supplied as steam in cold
G. weather and a fine mist spray in warm
 weather.

No p. Air is supplied mechanically by the draft
 created by the burning sulphur.

Sulphuric Acid (H_2SO_4) is formed as a
 result of the chemical union between water
P. (H_2O) as steam or water vapor—oxygen
Cl. (O) from the air, and sulphur dioxide
Sp. (SO_2) gas derived from burning sulphur as
 brimstone. The combination cannot take
 place, however, with these agents only at
p./tr. work and sulphuric acid can only be made
 by the chamber process through the agency
Sp. of nitrogen oxids acting as oxygen carriers,
Cl. as will be seen later.

Headings /p. The burners. Two rotary motor driven
 burners are used by the Jarecki Chemical
 Company. The burners are 4 feet in dia-
 meter and 16 feet long. Each has a burn-
 ing capacity of 700 pounds of sulphur per
 hour, but are only burning 400 pounds per
 hour. The burners rotate very slowly on
Gr./Tr. trunions so that the sulphur may have plenty
Sp. of time to burn. Half of the horizontal
p. cylinder contains molten sulphur and as the
p. burner rotates a large burning surface is ex-
p. posed. The ends of the burners are cone
p. shaped and contain air ports. The front
p. end supports a sulphur hopper and the rear
2 end leads into the niter oven.

The gas evolved contains from 9 to 12 per
 cent sulphur dioxide (SO_2) and about 18

Reference to a special process in line 28 shows the title of the whole section to be inaccurate.

The words "supervision" and "management" overlap. A more close-knit construction would be, "this process is so complicated as to necessitate careful supervision." Evidently this is the logical relationship intended.

Line 35. "Oxygen of the air" does not quite balance the other members of the series. Perhaps the last sentence of the paragraph will suggest a different wording. In the next two sentences, the geographical source of supply is given major emphasis. The entire paragraph needs revision.

The transition here is from one section to another. A more explicit "carry-over" is needed; for example, "At the Jarecki plant the brimstone is burned in two motor-driven rotary burners." This change would also keep the emphasis on the paragraph subject.

Line 63 "Only 400 pounds is, or are, being converted"? For a discussion of the general principle, see page 356. To avoid an awkward construction here, the phrasing may be changed to "The output at present is only 400 pounds," etc.

Lines 65-66. Is the meaning "so that" or in order that"? Note

which necessitates careful supervision and management.

The materials from which sulphuric acid is made are brimstone, nitrate of soda, water, and oxygen of the air. The brimstone, which is about 98 per cent pure sulphur, is obtained from Texas. The nitrate of soda, which is about 95 per cent pure, is obtained from Chile. Water is supplied as steam in cold weather and as a fine mist spray in warm weather. Air is supplied mechanically and by the draft resulting from the burning sulphur.

Sulphuric acid (H_2SO_4) is formed by the chemical union of the following three substances: water (H_2O) in the form of steam or vapor, oxygen (O_2) from the air, and sulphur dioxide (SO_2) from the burning brimstone. The combination, however, will not take place with only these three substances at work. Sulphuric acid can be made by the chamber process only through the agency of nitrogen oxides, which act as oxygen carriers.

The Burners. Two rotary motor-driven burners are used by the Jarecki Chemical Company. The burners are 4 feet in diameter and 16 feet long. Each has a burning capacity of 700 pounds of sulphur per hour. At present, however, only 400 pounds are being converted to sulphur dioxide per hour. The burners rotate very slowly on trunnions so that the sulphur may have sufficient time to burn. Half of the horizontal cylinder contains molten sulphur, and as the burner rotates, a large burning surface is exposed. The ends of the burners are 70

p./Tr. per cent of oxygen. This is enough in connection with the water vapor, to form the final product, sulphuric acid.

Ref.
Brief paragraphs

&

Cap.

Headings /p./Ref
Cl.

&

p.

p.
p. / p.

Style

Bulky
Phrasing

Sp.

Tr.

The gases mechanically carry over with them more or less "flue dust" composed of sulphur. This is in part scrubbed out by the tower process.

The burner gases, at a temperature which varies from 520° to 720° C/, pass through a large flue common to the entire burner system, over niter pots, through the Glover tower and on to the lead chambers. ==

The Niter Pots These are great cast-iron pots high in silica placed in connection with the burner-flues between the burners and the Glover tower. Nitrate of soda and sulphuric acid are fed into these pots from time to time as needed. The daily amount of nitrate of soda used is 1000 pounds and for every pound of niter 134 pounds of 50° Be sulphuric acid is required. The strong sulphuric acid replaces the weaker nitric acid and, combined with soda, forms a solid residue of sulphate of soda, the so called "niter cake" which is a by-product. The main product of this chemical reaction, namely, nitrogen trioxide (N_2O_3) pours over the edge of the pots as a heavy red-brown gas and is swept forward and into the mighty onward current of sulphur dioxide and oxygen.

The function of the nitrogen oxides which are thus evolved and which shift about in the chamber space from one form to another and back and forth in strange and temporary combinations with the gaseous molecules, is that of an "oxygen carrier." The sulphur dioxide (SO_2) must be converted into sulphuric acid (H_2SO_4) and can only thus combine if an oxygen is employed which of itself does not enter into the chem-

carefully the distinction between these two forms.

Line 77. The reference of "this" is not immediately clear.

The meaning of "flue dust" is not clearly indicated. The comma following sulphur (line 80) should be omitted. Perhaps further revision is needed.

The clause, "which vary in temperature," etc. (lines 83-84), is forced, or lugged in. Can it be incorporated more smoothly elsewhere?

Line 90. The phrase "high in silica" does not convey definitely the intended meaning.

Lines 92-93. The phrase, "between the burners and the Glover tower" is not very definite in its reference.

Line 101. A comma is needed after sulphate, to show the "or" of equivalence.

coneshaped and contain air ports. The front end supports a sulphur hopper, and the rear end leads into the nitre oven.

The gas evolved contains from 9 to 12 per cent sulphur dioxide (SO_2) and about eighteen per cent of oxygen. This, in connection with the water vapor, is enough to form the final product, sulphuric acid.

"Flue dust," consisting of sulphur, which is mechanically carried over by the gases, is in part scrubbed out by the tower process. The burner gases, which vary in temperature from 520° to 720° C., pass through a large flue common to the entire burner system, over the nitre pots, through the Glover towers, and on to the lead chambers.

The Nitre Pots. The nitre pots, which are composed of cast iron high in silica, are placed in connection with the burner flues between the burners and the Glover tower. Nitrate of soda and sulphuric acid are fed into these pots from time to time as needed. The amount of nitrate of soda used daily is 1000 pounds; and for every pound of nitre, $1\frac{3}{4}$ pounds of 50° Baumé sulphuric acid is required. The sulphuric acid reacts with the nitre to liberate nitric acid gas and to form a solid residue of sodium sulphate or "nitre-cake," which is a by-product. The main product of this chemical reaction, nitrogen trioxide (N_2O_3), pours over the edge of the pot as a heavy, red-brown gas and is swept forward by the current of the gases from the burner.

The nitrogen oxides, which are thus evolved and which change from one form of gaseous oxide to another in the

ical combination but transports or transfers the needed molecule.

Style The nitrogen oxides, as will be noted later, sweep onward in their course through the lead chambers and are in the main recovered by the tower system for further use as oxygen carriers.

Cl./p. Constant attention is paid to the regulation of the air or oxygen and water inlets since excess or shortage of either or both would be likely to lessen the ability of the nitrogen trioxide to do its full service in converting sulphur dioxide into sulphuric acid and to cause undue losses. These precautions are taken because of the high cost of nitrate of soda and sulphur.

Cl. The internal regulation of these relationships is still further secured by a careful oversight and control of the temperature throughout the chamber system, especially in the first chamber; by noting the color of the gases, in the chamber through "sights" introduced for this purpose. If the temperature of the first chamber runs higher than normal, the probability is that too much nitrate is being used, while if it runs too low it is likely that an insufficiency is being used. Over usage of nitrate is highly undesirable not only on account of the wastage but the fact that acid fumes if in excessive quantity tend to dissolve the sheet lead and rapidly to destroy the chambers.

Sp. The Glover Tower. The hot (520°-720°C) gases, composed of sulphur dioxide, oxygen and nitrogen (air from the burner) and nitrogen oxides from the niter pot, pass onward to the Glover tower. This device is a tall upright square tower 12 ft. x 12 ft. square and 25 ft. high, built of heavy lead sheets and lined with acid-proof brick, and packed in pigeon-hole fashion with shale

Bulky phrasing

G.

W.W.

W.W.

p.

G

p.

Abbr.

The technical expression "oxygen carriers" is not clearly explained, though an explanation is hinted in lines 112-113. The meaning of this term should be given more explicitly.

The phrasing should indicate clearly that air and water are not admitted together but through separate inlets.

The logic of the last sentence (lines 129-132) is mixed. A concluding expression is indicated by "therefore" and the sentence pattern ends with "uniform supply of air and water." The last part of the sentence, "because the cost," etc., introduces a new idea for which the reader is not prepared.

Line 136. The word "observance" seems unsuited to the meaning.

Lines 139-142. Better logical parallelism as well as better preparation for the following sentence is obtained by substituting after "indicates" the phrase "a corresponding excess or deficiency in the consumption of nitrate."

chamber, act as "oxygen carriers." The sulphur dioxide, under the catalytic effect of the nitrogen oxides, combines with the oxygen of the air to form sulphur trioxide (SO_3), which then dissolves in the water to form sulphuric acid (H_2SO_4). The oxides pass through the lead chambers into the tower system, where they are recovered almost completely for further use as oxygen carriers.

The air and water inlets to the chamber are kept under constant supervision, because excess or deficiency of either or both of these substances would prevent the most efficient conversion of the sulphur dioxide to sulphuric acid. Any deviations from the correct conditions would result in losses. Precautions are taken, therefore, to maintain a uniform supply of air and water, because the cost of sulphur and of sodium nitrate is high.

The correct temperature control throughout the chamber system, especially in the first chamber, and a careful observance of the color of the gases through "sights," are instrumental in assuring efficient operation of the process. An abnormally high or low temperature in the first chamber indicates a correspondingly high or low consumption of nitrate. Over-consumption of sodium nitrate is highly undesirable, not only because of the wastage, but also because of the tendency of excess acid fumes to dissolve the sheet lead of which the chambers are made.

The Glover Tower. The hot gases, composed of sulphur dioxide, oxygen, and nitrogen (air from the burner), and

8 ENGLISH APPLIED IN TECHNICAL WRITING

<p><i>S</i></p> <p><i>Sentence</i></p> <p><i>Unity</i></p> <p><i>Cl.</i></p>	<p>tile and shale brick. As the hot gases pass upwards/ they bubble through a falling shower of relatively dilute sulphuric acid which is evenly distributed by an ingenious device made of lead and located at the top of the Glover tower <u>in such a manner</u> as to cause the fluid uniformly to cover and to trickle down during its fall over the entire packing. The acid used in the Glover tower is a mixture of the "nitrous vitrol" from the bottom of the Gay Lussac tower (later) and of <u>Chamber</u> acid, the one 60° Baume (77.7 per cent acid), the other dilute, 50° Baume (62.2 per cent acid). The mixture which starts at the top of the Glover, at about 54°—emerges at the bottom at 60° Baume, becoming considerably concentrated during its downward passage. It is then cooled in large cylindrical tanks containing lead coils through which cold water circulates. The acid is then ready to be returned to the top of the Gay Lussac tower.</p>
<p><i>Sp.</i></p> <p><i>I.C.</i></p> <p><i>p.</i></p> <p><i>tower</i></p> <p><i>p</i></p> <p><i>Con.?</i></p> <p><i>In</i></p> <p><i>See rules</i></p> <p><i>for the</i></p> <p><i>placing of</i></p> <p><i>tabular</i></p> <p><i>matter</i></p>	<p>According to the <u>explanation given</u>, the Glover tower serves five distinct purposes:</p> <ol style="list-style-type: none"> (1) The cold and falling rain of nitro-sulphuric acids cools the hot burner gas fumes rising through the packing material so that they enter the lead chamber system at a relatively low temperature. (2) The hot fumes drive off much water from the relatively dilute acid and thus serve to some extent to concentrate it. (3) The moisture driven off from the dilute acid is returned to the chambers for further work. (4) The acid thus heated cannot retain the nitrogen trioxide gas which was absorbed in the nitrous vitrol in the Gay Lussac tower. It is therefore released and re-enters the lead chambers along with the burner gas

If the nitrogen oxides are included in the "hot gases" (l. 148), the first "and" (l. 149) should be omitted.

Even with an accompanying diagram, the phrase "an ingenious device made of lead" is not satisfying. The reader is led to ask, "Ingenious in what respects?" The context should furnish the answer.

Special typography is helpful in making clear the five units of tabular matter. Note that these units are also made grammatically parallel with one another.

Two cases of the indefinite "it" occur, lines 184 and 191. Rephrasing is needed at these points.

nitrogen oxides from the nitre pot, pass 151
to the bottom of the Glover tower. 152
This structure is a tall tower 12 ft. 153
square and 25 ft. high, built of heavy 154
lead sheets and lined with acid-proof 155
brick. It is packed in pigeonhole fash- 156
ion with shale tile and shale brick. As 157
the hot gases pass upward, they bubble 158
through a shower of relatively dilute 159
sulphuric acid, which is evenly distrib- 160
uted by an ingenious device made of 161
lead. This distributor, which is located 162
at the top of the Glover tower, causes 163
the liquid to trickle down uniformly 164
over the entire packing. The acid used 165
in the Glover tower is a mixture of "ni- 166
trous vitriol," 60° Baumé (77.7 per cent 167
acid), and chamber acid, 50° Baumé 168
(62.2 per cent acid). Nitrous vitriol is 169
obtained from the bottom of the Gay- 170
Lussac tower, which will be described 171
later. 172

The Glover tower serves five distinct 173
purposes, as follows: 174

- (1) The cold rain of nitro-sulphuric 175
acids cools the hot burner gas 176
fumes rising through the packing 177
material so that they enter the lead 178
chamber system at a relatively low 179
temperature. 180
- (2) The hot fumes drive off much 181
water from the relatively dilute 182
acid and thus serve, to some extent, 183
to concentrate it. 184
- (3) The moisture driven off from the 185
dilute acid is returned to the cham- 186
bers for further work. 187
- (4) The acid thus heated cannot retain 188
the nitrogen trioxide gas which was 189
absorbed in the nitrous vitriol in 190

and oxygen and again assumes its former functions as an oxygen carrier.

p. (5) Incidentally a little sulphuric acid is formed in the tower by the oxidation of the vapors.

Headings/Ref./N.W. The Lead Chambers These immense structures make up the great bulk of the acid plant. There are five chambers: the first

Abbr./p. is 30' x 50' x 24'; the second 30' x 60' x 24'; *p./Abbr* the third 30' x 50' x 24' and the fourth and *Abbr./o.* fifth each 30' x 40' x 24'. In between the

p. first and second and the second and third chambers there are small "reaction towers" which serve to mix the gases. These tow-

Abbr./Cl. ers are 5' x 10' x 18' high. The relation of chamber space to burner capacity is approximately 11 cubic feet per pound of sulphur burned daily. The chambers are built of

sheet lead weighing from six to eight pounds per squarefoot. The sheets are

Ref. welded together by the process known as "lead burning," using a blow pipe. That *p.* is the edges of the sheets are melted and run together and not soldered. The great

o weight of the chambers is supported by exterior wooden framework. The chambers are so constructed that the sides are neither

G fastened to or touch the bottom, but are set *p.* down as it were near to or within the continuation of the bottom raised up as an

Cl. edge along the sides. The joint is sealed by the use of a sufficiency of chamber acid to form a liquid seal. This peculiar method

of construction is employed in order to allow for expansion and contraction. Ther-

G. mometers are inserted and ^drip^ arranged at various points along the system so that the operator may know what is going on. Temperature readings, hydrometer tests of the strength of the acid, and chemical analyses showing the proportions of sulphur-

the Gay-Lussac tower. It is there- 191
fore released and re-enters the lead 192
chambers along with the burner gas 193
and oxygen and again assumes its 194
function as an oxygen carrier. 195
(5) Incidentally, a little sulphuric acid 196
is formed in the tower by the oxida- 197
tion of the vapors. 198

*This passage is im-
proved by a change to
tabular arrangement and
to the use of abbrevia-
tions instead of symbols.*

The Lead Chambers. The great bulk 199
of the acid plant is made up of the lead 200
chambers. There are five chambers 201
having the following dimensions: 202

*The text does not show
clearly whether just one
small reaction tower is
placed between each pair
of chambers.*

No. 1—	30 x 50 x 24 ft.	203
" 2—	30 x 60 x 24 "	204
" 3—	30 x 50 x 24 "	205
" 4—	30 x 40 x 24 "	206
" 5—	30 x 40 x 24 "	207

*Lines 218-219. The
idiom is wrong in the ex-
pression "welded together
with the use of a blow
pipe." A change to the
correct form will neces-
sitate rewording the last
part of the sentence in
order to avoid awkward
phrasing.*

*Line 225. (Also lines
238-239.) For concise-
ness as well as for
smoothness, one "of the"
should be omitted. A
discussion of the princi-
ple involved here will be
found on page 354.*

Between the first and second and be- 208
tween the second and third chambers 209
there are small reaction towers, which 210
serve to mix the gases. These towers are 211
5 ft. by 10 ft. by 18 ft. The relation 212
of chamber space to burner capacity is 213
approximately 11 cubic feet per pound 214
of sulphur burned daily. The chambers 215
are built of sheet lead weighing from 216
six to eight pounds per square foot. 217
The sheets are welded together with the 218
use of a blow pipe by a process known 219
as "lead burning." That is, the edges of 220
the sheets are not soldered but are 221
melted and run together. The great 222
weight of the chambers is supported 223
by exterior wooden framework. The 224
edges of the bottom of the chamber are 225
bent upward at a right angle. The 226
walls, although not touching the bot- 227
tom, are set down within the edges. 228

ous and of nitrous acids at given points furnish the main indications of the successful operation of the chamber.

Con.?
Paragraph incomplete Nitrous oxide (NO) is determined by titrating the acid with a standard solution of potassium permanganate.

As the gases pour into the chambers they come in contact with a constant mist of water which is thrown into the top of the chamber by means of a fine spray device.

Rep. This device is made of stoneware surrounded by an alloy of lead-antimony. In winter steam is used and the mist spray, in summer. More water than is really

P./G. needed to make acid, is thrown into the system, in order surely to convert as nearly as may be all of the sulphurous into sul-

K.
Rep. phuric acid and in order too that a too concentrated acid may not be made which would tend to absorb undue amounts of the nitrogen oxids. The gases and the water vapors pass slowly onward through the great chamber system and its intermediates, forced along their way in the main by the draft caused by the tower action in part by a 5 HP fan, in part by the currents caused by the chemical reactions. The waste products pass out of the system by way of the Gay Lussac tower.

Sp.
J/W.W.
p.
p./i.c./and

one The fullness of the chambers varies from $\frac{1}{2}$ inch to 20 inches. The strength of the acid in the chambers is about the same and is dependent upon the drips. The drips are the drops of sulphuric acid formed as a mist in the chamber space, and drop as a liquid to the floor. The drips are about 4° Be weaker than the acid in chamber bottom. The acid is drawn from the chamber by lifting a plug, which is located in the chamber bottom.

Sub.

Uniformity in length and kind of sentences preceding and including these, creates a somewhat disconnected style.

If the phrase, "at various points," etc., is meant to modify both "are inserted" and "is arranged," it should be transposed to the beginning of the sentence.

Note the grammatical awkwardness of "Steam and mist spray are used."

A close-knit structure is needed in order to correct the loose, "tacked-on" construction of "which would tend," etc.

Line 258. "Combined" seems to be in the wrong place. The series which it introduces should be rearranged for clearness and smoothness.

The open joint is sealed with sufficient chamber acid to form a liquid seal. This peculiar method of construction is employed in order to allow for expansion and contraction.

Thermometers are inserted, and the drip is arranged at various points along the system so that the operator may know what is occurring. Temperature readings, hydrometer tests of the strength of the acid, and chemical analyses showing the proportions of sulphurous and of nitrous acids at given points, furnish the main indications of the successful operation of the chamber.

As the gases enter the chamber, they come in contact with a mist of water which is sprayed in at the top. The spraying device is made of stoneware surrounded by an alloy of lead and antimony. Steam and mist spray are used in winter and summer respectively. An excess of water is injected into the system to prevent the formation of a too concentrated acid which would tend to absorb undue amounts of nitrogen oxides. The gases and water vapor are forced slowly through the large chamber system and through its intermediates by the combined means of a draft caused by the tower action, a five-horsepower fan, and currents caused by chemical action. The waste products leave the system through the Gay-Lussac tower.

The depths of the acid in the chambers vary from one inch to twenty inches. The strength of the acids, which depends on the drip, is about the same for each chamber.

CHAPTER IX

TYPES OF WRITTEN WORK

IN what has been said so far concerning the application of the principles of good writing to the student's everyday manuscripts no effort has been made to recommend a stereotyped uniformity. On the contrary, emphasis has been placed on the importance of variety and of adaptation. It is recognized that every piece of writing is, or should be, done for a specific purpose and under a particular set of conditions. Any attempt to present a standard "foolproof" model for every composition which the student might be called upon to write would be as futile and absurd as the aim of the old-fashioned "ready letter writer" to anticipate every possible situation in an individual's private correspondence. Slavish copying of models destroys a writer's originality and leads him to neglect the subject matter of his composition as well as to ignore the particular circumstances under which it is written. In so far as models are used they should be studied for the sake of the principles which they illustrate. The question is not so much what form is illustrated as why a particular form is desirable. It is hoped that in the following discussion sufficient illustrations will be furnished to make clear the explanation of essential requirements, but the student is warned against using the examples as stock forms, to the prejudice of his own freedom of expression. They are meant to be only suggestive and typical.

Another reason why it seems preferable to avoid insistence upon standard forms is that the specific conditions which govern student manuscripts vary widely in different depart-

ments and at different times. The principles of logical organization and clear arrangement are the same in any case, but the nature and extent of subject matter may be very different in two sets of reports, even though they are prepared for the same department. The instructor in the technical subject may be depended upon to indicate the content desired. The student's problem is to organize and present that content so that it can be readily understood.

It has already been emphasized that the preparation of student manuscripts affords preliminary training for the writing which will be done by the technical graduate in his professional work. Although we shall be concerned primarily with the types of written work which are done in college, it will be seen that they are not dissimilar, even in form, to the corresponding kinds of "outside" manuscripts. The fundamental requirements of the two are of course identical. Careful study of the principles of good writing and regular application of these principles in student manuscripts will be found the only means of insuring for graduates a quality of preparation in English commensurate with their technical knowledge.

MATHEMATICS PROBLEMS

In order to get the most out of his study of the following kinds of written work, the student should keep a file of all his manuscripts, arranged in chronological sequence. The examples thus collected will furnish documentary evidence of his progress and will provide a definite basis for exercises and conferences. Moreover, if he writes the manuscripts with a view to preserving them, he will naturally be inclined to take greater pains with their form.

The student's first impression may be that the writing of mathematical papers does not involve English composi-

tion at all. It is true that most of the ideas are stated in terms of numerals and symbols, and that the problems are accompanied by a minimum of connected discourse. Although few sentences need be written, it is nevertheless imperative that those which do appear should be absolutely clear and complete. There is no better exercise in English than the stating of a problem or the explanation of its solution. Such writing is pure logic, and is of inestimable value as training in expression. It is the best possible illustration of the fact that clear writing depends upon clear thinking.

Even details of mechanical form have a special significance in the presentation of mathematical problems and solutions. The placing of signs and symbols or of subscripts and exponents is relatively more important than the dotting of i's and the inclusion of punctuation marks in writing. Unless every mark is included and is written so plainly that it can readily be seen, the whole intention of the writer may be misunderstood. It is not surprising, therefore, that every set of regulations for manuscripts in mathematics should lay special stress on clear arrangement of material and on neat and legible handling of details.

The following instructions represent the minimum requirements for manuscripts, as set forth by a department of mathematics.¹

All work in mathematics and mechanics must be written neatly and systematically on 8½ by 11 loose-leaf paper. If two or more sheets are required they should be numbered and fastened together with a metal clip.

In the upper right-hand corner of the first page should be placed the student's name, the number of the course and section, and the date when the problems are due; for example:

¹ For an example of more detailed specifications, the student is referred to the pamphlet *Notes and Problems for Engineering Courses* by William E. Duckering, Professor of Civil Engineering, University of British Columbia. This pamphlet, which also contains a list of problems and an outline for analysis, is published by the McGraw-Hill Book Company.

Jones, H. K.
Math. 1, Sec. 3
Oct. 5, 1925

The page and number of each problem should be written in the left-hand margin; thus: p. 36—5. Every problem should be followed by a concise summary of the results, the conclusion of the problem being indicated by "Ans." written in the margin. Except for the numbering of the problems and the abbreviation "Ans.," the margin must be left blank in order to leave space for criticism.

Consecutive problems should be separated by a blank space.

Graphs should be drawn on 8½ by 11 cross-section paper. It is best to use a firm-bodied paper so that erasures can be made. In drawing graphs the student should be sure to indicate the axes and to mark the scales on each axis.

Work in mathematics which does not conform to the above requirements or which is not neatly and legibly written will not be accepted.

CHEMISTRY MANUSCRIPTS

As in mathematics problems, so in chemistry notes, there is a maximum of expression by means of symbols and numerals, and a minimum of connected discourse. The obviously convenient and sensible arrangement is to express as many ideas as possible in terms of symbols and equations, and to group these in the form of tabular statements wherever feasible. It would be absurd to suggest that material which is already clearly and intelligibly presented should be translated into more bulky language for the sake of creating an exercise in English.

And yet, even with a maximum of signs and symbols, a certain amount of explicit language is necessary. Furthermore, it is important that the few statements which are made should be clear and accurate. For the very reason that a great deal of chemistry lends itself readily to abbreviated expression, there is danger that the student may form habits of writing everything in a cryptic, shorthand

form. Thus, in a sentence which is meant to be a complete statement, he may write, as one student did,

Req. amt. of dil. sol. of HCL placed in beaker.
instead of

The required amount of a dilute solution of HCL was placed in a beaker.²

By observation of the way in which chemical data are presented for various purposes the student will soon learn to differentiate between the contexts in which abbreviated or tabular forms are permissible and those in which complete connected discourse is required.

Specific requirements for manuscripts in chemistry courses will necessarily vary widely with circumstances. Particularly in laboratory reports on quantitative analysis it may be found that tabular statements will suffice. Special problems, as in volumetric determinations, may call for a considerable amount of written explanation and discussion. The instructor in chemistry will indicate the manner in which the manuscripts are to be prepared. The following directions are cited as typical of the requirements for chemistry reports:

DIRECTIONS FOR WRITING REPORTS IN CHEMISTRY

Notes are to be written neatly in ink at the time when the experiment is performed.

At the beginning of each laboratory report, enter the date at the head of the page in the chemistry notebook.

Write only on the right-hand page of the book. The page at the left is to be reserved for corrections, and for drawings of apparatus used in the experiments.

In writing a report of an experiment, do not merely reproduce the directions, or give short and disconnected answers to the ques-

² We need not insist upon the complete form, "hydrochloric acid," since "HCL" is an authorized abbreviation and is clearly intelligible. As a rule, however, it is better to write out the words and place the symbols after them in parenthesis.

tions asked. The directions and questions are to be taken simply as a guide to the points which should be covered by the report. Consider the experiment as a whole; then write the report, expressing briefly all the essential phenomena observed and the conclusions to be drawn from the experimental evidence. Assign a proper title to each experiment, and number it to correspond to the number in the manual.

It is preferable that quantitative data be given in tabular form. For example, Experiment 8a might be written as follows:

8a. WEIGHT OF 1 CC. OF WATER

Weight of beaker containing 12 cc. of water	35.56 g.
Weight of beaker	23.60 g.
Weight of 12 cc. of water	11.96 g.
Temperature of water	25°C.
∴ 1 cc. of water weighs	$11.96 \div 12 = 0.996$ g.

In reports of unknowns, the arrangement given below should be followed:

Unknown, Tuesday, July 21, 1925.

Substance	Reagent	Observations	Conclusions
1. Clear solution	$\text{NH}_4\text{OH}-\text{NH}_4\text{Cl}-$ $(\text{NH}_4)_2\text{CO}_3$	White ppt.	Group IV
2. Ppt. No. 1	$\text{NC}_2\text{H}_3\text{O}_2$	ppt. dissolves	
3. Solution 2	K Cr O	Yellow ppt.	Ba present

Abbreviations and symbols alone may be used in tabular statements; but in connected discourse the name of a compound should be written out, and the symbols, if given, should be put in parentheses immediately after the name of the compound. Thus,

The products resulting from the combustion of pyrites are ferric oxide (Fe_2O_3) and sulphur dioxide (SO_2).

As in other technical writing, use the *third person, the past tense*, and the *passive voice*. For example, do not write in the imperative as if you were giving directions, as

Weigh a beaker of water containing 12 cc. of water.

Likewise, avoid the first person narrative style, such as

I weighed a beaker containing 12 cc. of water.

Even worse is the telegraphic first person style, such as

Weighed a beaker containing 12 cc. of water.

Instead of using any of the foregoing unacceptable forms, write,

A beaker containing 12 cc. of water was weighed.

The emphasis is on *what was done*, and not on the person who did it.

NOTES

Because the subject matter of many courses can best be presented in the form of lectures, the taking of notes is a familiar part of every student's written work. The notes written by a student form a considerable part of the evidence concerning what he has learned from a course. However, the mere fact that note taking is a universal necessity does not warrant the assumption that it is done well by everybody. On the contrary, the very familiarity of the process causes it to be taken for granted, and consequently to be given less attention than it deserves. It should not be forgotten that note taking, instead of being a mere copying process, is an important form of studying. It involves not only the acquiring but also the classifying of knowledge. The resulting notes are judged partly by what they include, partly by what they omit, and partly by how they are organized.

In selecting and combining data for his notes, the student will find use for all that he has learned about the logical organization of material. If the notes are taken in the classroom, he will follow the instructor's outline, putting down the principal divisions and subdivisions in such a way as to form a basis for reconstructing the entire lecture. He should omit subordinate details, since these may readily be supplied at any time if the general principles which they illustrate are clearly understood and are completely summarized in the notes. The fact that the student has not time during the lecture to make a detailed or verbatim record of what is said, is really an advantage. Since he cannot possibly take down everything, he must select and evaluate material. This process compels him to think about the subject in its true proportions and to arrange the divisions of his material in logical order. Incidentally, it

calls for close concentration during the class hour, or for what has been termed "creative listening." An experienced instructor, in looking over a set of notes, can tell the precise point at which a student's mind wandered. He can also discover to what extent the student has been accustomed to organize material, for in rapid note taking, it is the habit of classification that counts most.

By a brief examination of classroom notes, the instructor can also form an accurate estimate of the background of information which the student has had as a basis for understanding the lecture. Very often a lecture is based to some extent on reading which is assigned to be done in advance. Certain proper names and scientific terms mentioned in the lecture may thus be assumed to be familiar, and the instructor may feel free to speak of them without formally introducing them or spelling them out. If the collateral reading has not been done in such cases, the notes will betray the fact unmistakably. Every instructor has his own collection of specimens illustrating the inadequate background of students. Perhaps a student who first encounters in the classroom a word which he should have met earlier in print, puts down "John Buskin" for "John Ruskin, as one actually did, or writes of the "Dog" of Venice instead of the Doge, or of a "monogram" on Gothic Architecture instead of a monograph, or of a "coreless" instead of a Corliss engine.

Whatever the inaccuracy may be, the significance lies not so much in the particular error as in the essential superficiality or ignorance of which it is symptomatic. A sure way of avoiding such mistakes, both in classroom notes and in the examination papers which review the notes, is to prepare for lectures by study in advance. That such study will also facilitate the organization of lecture material is self-evident.

If notes are drawn from printed sources instead of from spoken lectures the process of organizing the material is essentially the same. Since he is unhurried, the student may be expected to show greater care in selecting, phrasing, and arranging his topics, and greater accuracy in handling details. He may also have greater latitude in choosing the particular equipment with which to keep his notes. For example, he may use a card file for notes made in the library. Especially if the material is expected to be permanently valuable, this plan is to be preferred to the use of the customary notebook. For our present purpose, however, the medium is not so important as the notes themselves.

Broadly speaking, notes from printed sources may be written either as suggestive phrases or as definite statements. They may consist of topical outline headings, like those on page 54, or may be put in the form of complete sentences. The latter type of summary has the advantage of being definite and explicit, and, since the writer has plenty of time, the difficulty of phrasing is not an obstacle. Below is an example of the sentence outline, based on Chapter I of John Dewey's *How We Think*.

WHAT IS THOUGHT?

The words thinking and thought are variously used to designate (a) what we are conscious of, (b) what is not directly presented to our consciousness, or (c) what we believe, either with or without the support of evidence or testimony.

Ideas or fancies which pass at random through our minds do not lead to reflective thought, because they do not grow out of one another and support one another.

Imaginative incidents and episodes which we invent as fiction may resemble reflective thought in the logic of their sequence, but they do not aim at knowledge, or belief in truths.

Thought which represents belief may range from the mere acceptance of an idea as an act of assent, to the reaching of a conclusion

as an act of reasoning. It is the second of these that is properly called "reflective thought." Men *thought* the earth was flat until Columbus *thought* (i. e., *reasoned*) that it was round.

Reflective thought, therefore, is "active, persistent, and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it and the further conclusions to which it tends."

The sentences which summarize a discussion may be put in the form of an abstract. The purpose of an abstract is to give a concise résumé of the contents of an article. The abstractor does not review the article in the sense of criticizing or judging it. He merely sums up its content in his own language keeping the proportions and the emphasis of the original. At the same time, he includes a complete reference for the benefit of any one who may wish to consult the original article. The following example, quoted from Social Science Abstracts for February, 1932, will serve to illustrate the method:

2734. SWOPE, GERARD. Stabilization of Industry. *General Electric Review* 34(10), Oct. 1931: 543-547.—An outline of the important features of a plan for the stabilization of industry is presented, together with a statement of certain underlying principles. All industrial and commercial companies with fifty or more employees and doing an interstate business must form a trade association under federal supervision which will work towards stabilization. Considerable attention is given to the protection of employees. This phase is considered under the four headings: (1) a workman's compensation act, (2) life and disability insurance, (3) pensions, (4) unemployment insurance. Both the employer and the employee contribute to the protective funds set up under this plan. The general plan tends to put all domestic corporations on a parity for domestic business. The cost of these items will be reflected in the price of the product and will be borne by the users of the product instead of by the members of the general community who might be reached by the vicarious method of taxation in case industry should leave the problem to legislative action.—George C. Campbell.

The suggestions which follow will be found helpful in the making of abstracts:

Without attempting to make notes as you go, first read the selection through carefully.

Make a mental or a written outline, noting the principal points in the discussion, their connection, and their relative importance.

With the whole fresh in your mind, write a brief and simple statement for the benefit of some one who has not read the discussion.

Include with each abstract a complete reference to the original article.

If the student is making notes purely for his own information and not for submission to the instructor he may find almost unlimited scope for his individuality in the treatment of his material. Even so, the essential requirements of accuracy, clear arrangement, and permanently intelligible phrasing should be followed. If, as more often happens, his notes are subject to periodic inspection, he will doubtless be given specifications to be followed in each course. The directions given below are cited as being fairly representative of the minimum requirements for note taking.

SAMPLE DIRECTIONS FOR NOTE TAKING

Equipment. The student will provide himself with a standard loose-leaf notebook using filler $8\frac{1}{2}$ by 11 inches. Ruled paper of good quality is required. Notes are to be taken with fountain pen and black ink.

Form and content. Under topical headings arranged in the same manner as the subheadings of these instructions: e.g. "Equipment," "Form," etc. the student will write a clear, concise statement of the principal points in the lecture. Phrases and other abbreviated expressions are acceptable, provided that they are clear and explicit. For example, the following summary is a satisfactory substitute for connected discourse:

SERBIA (1913). Area, 19,850 sq. mi.; pop., 2,911,701; peace strength of army, 981,747. Const. monarchy: King assisted by 8 ministers responsible to him and to national Assembly. Latter body, 166 Deputies elected by people, meets yearly.

Only obvious abbreviations should be used. Ambiguous or non-committal phrases must be avoided; for example, not *Richelieu's attitude toward feudal aristocracy*, but *Suppression of feudal aristocracy by Richelieu*, or some other self-explanatory phrase. The use of a verb, as in newspaper headlines, is often effective; for example,

Richelieu breaks power of feudal nobility by dismantling fortresses
not needed for defense against foreign invasion.

Topical headings, by reason of their brevity, cannot always be explicit; but notes placed beneath these headings should be detailed, and should be immediately and unmistakably clear. Only quotations the original form of which is significant should be given verbatim. Examples are definitions, rules, and important official utterances. Reports on lectures and on collateral reading should be in the form of outlines and abstracts, and not of shorthand notes or detailed transcripts. In other words, what is wanted is analysis, and not copying.

Notes on manuscript corrections, collateral reading, special problems, and other allied study, will be placed in separate departments of the notebook, appropriately headed. Since these exercises can be prepared with greater care than the class notes, the highest standards of clearness and neatness will be applied in their inspection. It is suggested that one division of the notebook be set apart for recording the instructor's criticisms of the student's oral presentation.

Mechanical Details. Notes on each lecture must be begun on a new sheet of paper with the serial number of the lecture, the title, and the date written at the top of the page. For identification of detached notes, the student's name and classification will be placed in the upper right-hand corner of the first page for each lecture. Writing on both sides of the paper is permissible in classroom notes. Typewritten copies should be written on only one side of the paper. Pages throughout the notebook will be numbered consecutively from page 1 of Lecture I. All writing must be in a horizontal line across the page. Punctuation, legibility of penmanship, spacing of words, indentation of headings, and general neatness of manuscript will be closely watched, since these are among the factors which determine a student's grade.

Routine. Notebooks will be taken up for inspection on dates to

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be announced later. Notes taken during the period of inspection will be written on standard paper and will be transferred to the regular covers when the latter are returned.

LABORATORY REPORTS

Laboratory experiments range all the way from brief routine exercises to exhaustive tests. They may be intended merely to familiarize the student with the use of apparatus and with the elementary methods of research, or they may be designed to carry forward a complete scientific investigation. Laboratory reports are as varied as the experiments which they describe. They may range from a simple tabular or graphic summary to a detailed explanation of an entire process. Because the circumstances differ so greatly, it is manifestly impossible to establish a standard form which applies to all reports of experiments. Aside from the fact that the adoption of a rigidly set form would tend to cause a stereotyped and perfunctory handling of the material, such uniformity would prevent recognition of important differences in the subject matter and the purpose of laboratory reports. It is true that there are general principles and rules which apply to all reports, and that there is a logical sequence of steps to be described in every experiment. The most important requirements for laboratory reports will be shown in a typical outline. At the same time, however, it should be borne in mind that certain experiments may call for reports which differ widely in content and treatment from the suggested form.

It is probable that the instructor will wish to abbreviate and simplify many reports. If the purpose is merely to test the student's powers of observation and his understanding of the principles involved, a series of questions may be sufficient. Certainly no one would recommend that for the sake of completing a formal report the student should

write out laborious descriptions of familiar apparatus and processes. For example, if we may cite an everyday instance, a report on a chemical experiment need not include the statement that the apparatus consisted of a bunsen burner and some test tubes. These may well be taken for granted. It is only when the apparatus presents some special novelty, either in its individual parts or in their "set-up," that a description is necessary. The same is true of all other matters pertaining to the experiment. The need for incorporating them in the report varies with circumstances.

A complete report, as we have seen (pages 68, 69), presents a definite problem in the organization of material. If all the stages of the investigation are included and are described in a logical sequence, the result is a symmetrical composition whose introduction consists of a statement of the object and the method of approach and whose conclusion explains the significance of the data which have been gathered. Assuming that all divisions of a laboratory report are to be represented, as they often are, the following outline and suggestions will be found serviceable.

REGULATIONS GOVERNING LABORATORY REPORTS

By agreement between the Department of English and the technical departments, the outline given below has been adopted as the standard for complete reports. This outline is presented, not as an arbitrary form, but as a logical arrangement of material obtained from laboratory experiments. The instructor in the technical subject will indicate any departures from the standard outline, including the omission or abbreviation of certain parts.

The Department of English is not concerned with tabular statements, curves, and purely quantitative data, but confines its attention to those parts of the report which are written in connected discourse. Nor is the student's grade in English affected because of the omission of certain sections. However, the student will be held responsible for clear and complete statements within those divisions

of the report which are included and for observance of the requirements for correct mechanical form.

Object. The first division is the "Object." If an experiment has no object, it would seem useless, if not impossible, to perform it. The object can frequently be stated in the form of a simple declarative sentence, for example:

The object of this experiment was to determine the specific heat of zinc.

It will be noted that the past tense of the verb is used because the writer's point of view is that of one who has completed the experiment, and is now beginning to write a report on it.

Theory. The second division of the report is called "Theory." Under this head are given explanations of the principles or formulas involved, and definitions of unfamiliar terms. For example, in connection with the experiment indicated above, the following sentence might begin the division known as "Theory":

"The specific heat of a substance is the quantity of heat required to raise the temperature of one gram of that substance one degree."

The distinction between "Object" and "Theory" is so marked that these divisions should never be confused as in the following sentence from a laboratory report:

The object of this experiment was to raise the temperature of one gram of zinc one degree, which is called the "specific heat of a substance."

The material under "Theory" is given in the present tense because it consists of generalized scientific data, which are not confined to this particular experiment.

Apparatus. The third part, called "Apparatus," includes a list of important pieces of apparatus, together with a description of how they are connected or used, if the latter phase of the subject is important. In case it is necessary only to list the pieces of apparatus, a single sentence at the beginning of this division will suffice. For example:

The apparatus used in this experiment consisted of the following:

Procedure. The division known as "Procedure" comes next. It is a narrative in the past tense and passive voice, giving the steps in the performance of the experiment. The passive voice should be consistently used, since the account of the experiment is

in no sense a personal narrative. For example, the form used should be

Readings were taken at intervals of five minutes.

instead of

I took readings at intervals of five minutes.

In no case should the abbreviated or telegraphic form, "took readings at intervals of five minutes," be used.

Results. The section designated as "Results" belongs purely to the technical department. In its complete form, it includes sample calculations; numerical data, observed and derived; and graphical data. The last of these must be placed on cross-section paper and must be drawn in accordance with the technical instructor's specifications for curves.

Conclusions. The final section of the report is called "Conclusions." Under this head should be included not only deductions from the test but also an explanation of the theory required for interpreting the results. It is frequently desirable to include a discussion of the reasons for the particular phenomena observed in the test and of the factors which may account for any irregularities observed in the results.

The same general outline may be followed in reports of a very different type. Let us assume that instead of conducting tests in a laboratory the student is attempting to solve an economic problem—for example, the comparative costs of shipping package freight by motor truck and by rail within certain areas. Such an investigation, like the other, has an object, a theoretical basis of approach, a method of procedure, a body of data, and a conclusion. Aside from apparatus, which is usually lacking or unimportant, the main divisions are practically identical with those of a laboratory report. The general outline can be used to equal advantage by students in commerce, agriculture, engineering, or any other subject which calls for systematic investigation or experiment.

THESES

From the complete laboratory report to the thesis is only a step. The two may be said to differ in degree, rather than in kind, and in length, rather than in essentials of form. Each gives an account of an investigation, with details enough to explain the purpose, the method, and the result. A very important distinction, however, is that the thesis presumably represents an effort to make a contribution to existing knowledge.

From lists of thesis titles which are published from time to time one would infer that some of the investigations do not achieve the distinction of original research. This impression is confirmed by an examination of the theses themselves. Many of them, it is true, reflect on the part of their writers a scientist's regard for accuracy of observation and clearness of thinking and a scientist's perception of relative values. Others, unfortunately numerous, indicate a perfunctory attitude and a desire only to prepare something that shall look sufficiently like a thesis to be accepted. In the latter type of thesis there is evidence that the form has been neglected even more than the subject matter—that the material has been thrown together hastily at the eleventh hour in order to satisfy one of the requirements for a college degree.

The foregoing criticism does not have to do with the choice of subject matter for theses. That is entirely a question for the technical instructor. Our present concern is with the quality of the thesis as it is influenced by the student's interest in giving his material the best possible form of expression.

It is evident that if an investigation is really original it is a major problem in analysis. The thesis which forms a report of the investigation, therefore, should be a model of clear statement and of logical organization of material.

Since the investigator's findings are new, both his method and his conclusions are subject to challenge. To explain them in vague or ambiguous language would be to cast a doubt upon the clearness of his thinking and the trustworthiness of his conclusions.

One important result of careful analysis is conciseness of expression. A thorough study of the content of a thesis involves reducing every part to its essentials. Even borrowed material—for example, the history of previous investigations—will be analyzed and summed up in terms of its most significant phases. On the other hand, the thesis which is carelessly written and is thus developed without preliminary analysis, is certain to be bulky, tedious, and obscure. Contrary to a prevalent notion, a thesis does not impress the reader by its size, but by its quality. A thick manuscript is almost a sure sign of insufficient analysis. It is likely to be padded with historical or descriptive matter that has little or no bearing on the problem in hand. The writer of such a thesis may have gathered—or possibly, appropriated—a great deal of material; but he has not digested it.

The sooner the analysis begins, the better. In the following typical suggestions for the preparation of a thesis provision is made both for a preliminary statement and for reports at intervals prior to the submission of the first draft of the thesis manuscript. It is assumed that a long period of preparation will be required to produce an acceptable thesis, and that the steps in the process will be clarified in the investigator's mind if he is obliged from time to time to give an explicit statement of his progress.

SUGGESTIONS FOR THE PREPARATION OF A THESIS

Statement of thesis problem. The first report is a statement of the subject which has been chosen for investigation. It should

include an explanation of how the problem was suggested, of the theory underlying the investigation, and of the proposed method of approach. This report may be required more than a year before the completed thesis is due. From the foregoing brief summary of its content, it will be seen that adequate preparation for it involves a great deal of preliminary investigation and analysis.

Bibliography. Any one who undertakes to prepare a thesis should be familiar with what has already been written on the subject. A bibliography, or complete list of references, should therefore be included with the preliminary report and should also be incorporated with the final draft of the thesis. An exhaustive list of references is, in a sense, a guarantee of the writer's qualifications for dealing with his material. Whether he actually knows what others have written will be evidenced, of course, by his handling of the subject. The bibliography will show at least that he has provided for an essential part of the investigation.

The various details of the bibliography should be arranged for the reader's convenience. Books and signed articles should be listed alphabetically according to the author's surname. Unsigned articles which may be included should be placed in alphabetical order according to subject. Complete data for identification of works should be given, for example:

Herring, J. M.: Equalization of Broadcasting Facilities within the United States. *Harvard Business Review* 9 (4), 416-430, July, 1931.

Kirk, G. L.: The Design and Construction of Diesel Engine Fuel Pumps. *Engineering*, Vol. 106, No. 2759, pp. 549-551, Nov. 15, 1918.

Reports of progress. At intervals specified by the instructor, the student will submit accounts of what he has done toward completing his investigation. In each case, it may be assumed that the instructor is already familiar with the content of the earlier reports. The student's immediate purpose is therefore to summarize the procedure to date and to discuss any developments of special interest. Taken together with the preliminary statement, the reports of progress should constitute a complete review of the successive steps in the investigation. The structure of the thesis as a whole will grow with the preparation of these reports, until the assembling of the final draft will become a comparatively easy task.

Letter of transmittal. Each report should be preceded by a letter of transmittal, containing a concise statement of the subject matter. In the first letter, nothing need be given except the problem, which may be stated in a single sentence. In the letters introducing subsequent reports, a paragraph or more should be devoted to a summary of the progress already made. The following communication addressed to the professor in charge is suggested as a suitable form for a letter of transmittal:

Dear Sir:

The accompanying pages contain an outline of a proposed investigation of the feasibility of using low-grade fuel in motor-truck engines.

For the reasons set forth in the attached preliminary report I have chosen this subject as the one on which I should like to write my thesis for the degree of Mechanical Engineer. I shall be glad to have you criticize the subject and the proposed method of investigation.

Respectfully,

The final draft. The completed thesis should have a title page and a table of contents. These may be arranged as shown below:

The Circulation of Air
In a Cold Storage Room
A Thesis
Presented to the Faculty
of the
College of Engineering
by
Joseph Wade Brown
for the
Bachelor of Science Degree
in
Mechanical Engineering
(Date)

CONTENTS

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History of Refrigeration	7
Theory Underlying Refrigeration	8
Purpose of the Investigation	12
(See sample paragraph, page 205)	
Method of Conducting Experiments	13
Description of Apparatus Used	16
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Second Test Run	27
Explanation of Data	28
Calculations	30
Log Sheets	31
Curves	
Temperatures	35
Capacity and Velocity	36
Velocities across Ducts	37
Thermo-couple Calibration	38
Composite Temperature Curve	39
Conclusions	40

The make-up of the table of contents naturally varies with different subjects. A division into "Parts," or Chapters, is often preferable, as in the following:

COMPARATIVE TESTS OF GASOLINES

Contents

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Part I.—Introduction - - - - -	5
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By Power Tests - - - - -	75
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Photograph of gasoline-distillation apparatus - - - - -	12
Sketch of gasoline-distillation apparatus - - - - -	22
Specific gravity curves of gasoline - - - - -	27
Log sheet of distillation tests - - - - -	51
Distillation curves of gasolines for month of February - - - - -	67

A word may be added concerning the style of the completed thesis. Since the thesis is the student's masterpiece—the document which represents his greatest achievement in original research, it is only natural that he should wish to put it into the best possible form. Moreover, since a bound copy will become a permanent addition to the college library, it is obviously desirable that the finished thesis should be made clear and readable for the sake of those who may wish to consult it.

The following quotation indicates a fair average of style for the text of a thesis:

Until recently, little thought has been expended on the circulation of air in cold storage rooms, and coils have consequently been placed wherever convenient, with no provision for the return of warm air to them. Heat may pass from a warm to a cold body in three ways: by conduction, by radiation, and by convection. In an ice box or a cold storage room, convection is brought about by the use of air as a carrier of cold. Since cold air is heavier than warm air, it will fall to the bottom of the room, and, upon being warmed by the stored produce, will rise to the coils and give up its heat, provided that the passages are properly designed to permit this circulation. In this investigation it was proposed to determine what arrangement of

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cooling coils and air passages in cold storage rooms would permit the best natural circulation of air.

Much of the language will doubtless be technical, and properly so. The thesis is probably the best opportunity that the student has in his course to write purely technical style. Whether the style is technical or not is a minor consideration, to be determined by the subject matter. The chief requirement is that the student's presentation shall be clear, accurate, and concise. It is evident that these qualities in a writer's phrasing depend primarily upon the completeness of his analysis.

ENGINEERING REPORTS

In describing laboratory experiments and in preparing a thesis, the student gains experience which he can later apply directly in the writing of engineering reports. Although our present study is concerned chiefly with written work which the student does while he is in school, it should be pointed out that by giving proper attention to such work he will incidentally fit himself to handle easily the numerous writing assignments which will inevitably come to him in industry. His preparation, of course, will be general rather than specific. The reports which will form a part of his regular work in engineering practice will vary widely according to circumstances. They will range from tabular statements, made out on standard forms, to elaborate documents, planned entirely by the writer. They may describe every kind of technical operation from routine tests in a commercial laboratory to the highest type of original research. In every case, the external form should be determined by the use for which the report is intended.³ However, the general

³ For examples of typical engineering reports, together with a detailed discussion of how they should be written, the student is referred to the volume, *The Preparation of Reports* (Ronald Press), by Ray Palmer Baker, and to two other books which will be found useful additions to his working library, namely: *English for Engineers* (McGraw-Hill), by S. A. Harbarger, and *Effective Business English* (Macmillan), by A. G. Saunders.

principles which govern the analysis and arrangement of material and the statement of ideas will be found the same in engineering reports as in those which are prepared for college classes. Note the similarity of organization, for example, as shown by the following outline from an engineering report:

REPORT
on
OPERATION AND DEVELOPMENT
of the
SYNTHETIC AMMONIA PROCESS
(Cover and title page)

Letter of Transmittal

CONTENTS

Introduction	Page
I. Gas Production	1
Standard Water Gas Machines	7
Gas Holder and Standard Gas Purifiers	10
II. Carbon Monoxide Conversion	12
CO Converter and Heat Interchangers	14
Heat Supply	19
Condensers	22
III. Gas Purification	25
Compressors	31
Water Scrubbers	48
Caustic System	56
Brine Coolers	64
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IV. Ammonia Synthesis in Circulating System	84
Ammonia Converter and Heat Interchangers	87
Ammonia Liquefiers	95
Circulating Pumps	101
Storage Tanks	108

APPENDIX

Diagrammatic Flow Chart of
Direct Synthetic Ammonia Process

The principal difference between the two kinds of reports is in adaptation. With the actual conditions in mind the writer will constantly adjust the subject matter and the style of his report to his immediate purpose, and to his reader. Suppose, for example, that an engineer is employed to investigate and report upon the feasibility of utilizing certain waste products in a manufacturing enterprise. His client is a business man who wants only the answer to the question, "Will it pay?" For the convenience of his client, the engineer incorporates in the letter of transmittal a concise statement of whether the proposed plan to utilize such by-products is commercially feasible. Then, in support of his conclusion, he appends a full account of the investigation, explaining the technical problems involved, describing the procedure, and summarizing the results. If his client wishes to employ another engineer to check over the original investigation, the text of the report will be found ample to explain how the conclusion was reached, and to show whether it was warranted. The chief difference between this report and the conventional laboratory report is that, in this one, the conclusion is placed first. The general treatment is the same in either case.

It may be that the body of the report must be adapted in style so that it may be read and understood by non-technical readers. If the problem is to explain to a number of investors the technical features of a project in which they are interested, the engineer will need to translate the scientific facts of his report into simple language, intelligible to the average layman. Suppose, for example, that a company is being formed to produce electric current at the mouth of a coal mine and to distribute it over high-tension

transmission lines to neighboring industrial communities. To explain such a project clearly to the average person is in reality a literary problem as well as a technical one. It calls for a high degree of resourcefulness and adaptability on the part of the engineer in charge.

Not infrequently it happens that an engineer's report must reach and convince that heterogeneous body, the voting public. Since many of the largest engineering projects are political, or at least semi-political, the engineer must command the support of a decidedly non-technical group. A notable instance in which this was done with success was in the reports which were issued by Mr. Morris L. Cooke, author of *Our Cities Awake*, when he was Director of Public Works for the city of Philadelphia. He adopted the policy of making reports readable, but in carrying out this policy he went even further; he made them interesting. By means of graphs and illustrations he enlivened the statistical and technical parts of his reports, and in the descriptive sections he explained everything in language that could readily be understood by the average citizen. It is no disparagement of his record as an engineer to say that his most distinctive accomplishment was probably the translation of technical knowledge into popular language. The documents issued by his department established a high-water mark for engineering reports. In the fullest sense of the term this was also an engineering achievement, since it created the demand and opportunity for the carrying forward of important public improvements in the field of municipal engineering.

INSPECTION-TRIP AND WORK REPORTS

Inspection-trip reports. The making of inspection trips to various types of engineering projects is a familiar feature

of nearly every student's training. Reports based on such trips may take a variety of forms, depending upon the project visited, and upon the purpose of the instructor who planned the trip. In view of the fact that such visits are nearly always brief, the report which results is likely to be descriptive rather than analytical. The student is concerned with observation of engineering features and has no time for detailed study or analysis of the project.

Especially is this true of the visits which are made in order to acquaint the student with an industry as a whole. If the trip is made early in the student's course, it is not to be expected that he will have a basis of technical knowledge for the critical study of engineering processes. He is engaged in accumulating such knowledge, and the inspection-trip is one means of getting it. A bird's-eye view of the industry as a whole, then, is usually the plan for his inspection-trip report.

Even a descriptive treatment, with a broad, general view of the subject, presents a problem in the analysis of material. As he passes through a factory or examines a construction project the student gathers a miscellaneous assortment of facts and impressions. To organize this material into a descriptive composition which will give the reader a clear picture of the project or industry in question is not always an easy task. A certain amount of classification is necessary. As we have seen, however (p. 55), the basis of organization is usually inherent in the project itself. If it is a manufacturing enterprise, the description follows a logical sequence from the raw material to the finished product, and each division falls into its place in the chain of processes. Whatever the subject matter may be, a relationship can be discovered which furnishes the key to an understanding of the project as a whole at the same time that it gives the writer a starting point for the development of

his composition. A typical example of an outline for an inspection-trip report is found on page 54.

For advanced students who have a background of technical knowledge and who have begun to specialize, the inspection-trip may have a different meaning. It may furnish illustrations of principles with which the students are already familiar, or it may even serve as a test of their engineering judgment. The subject matter, of course, is more strictly limited than in the general report. Instead of visiting a whole manufacturing enterprise, the students confine their attention to a single feature, such as coal handling, shop lighting, power applications, experimental laboratories, or some other specific policy, method, process, or phase of equipment. It is evident that this type of report should be analytical as well as descriptive. It should be, in fact, a critical discussion of the specific problem which occasioned the trip.

Work reports. If the student's contact with an engineering project is made possible by his everyday experience, he may deal with the same type of subject matter as in the inspection-trip report, but in more thorough fashion. If his material is gathered at first hand and over a long period of time, it will of course be more complete. His observation will be closer and will probably lead him to investigate the *why* as well as the *how* of things. He will have opportunity to collect photographs, sketches, shop records, and even samples of the product manufactured or the materials purchased. All these advantages should make the "work report" more accurate, more comprehensive, and in general more interesting than the usual inspection-trip report. Especially should this type of report be distinguished for originality, since it is made from data which the writer has personally gathered, and concerning which he has had opportunity to form his own conclusions. (See p. 245.)

PAPERS

The term "paper" is usually applied to a composition which results from the investigation and analysis of a general subject. For example, a student may decide to prepare a paper on a subject like "Smoke Abatement," to be delivered before a club or to be submitted as a class assignment, collateral to the study of power plants. After collecting and sorting references (see page 239), he will read extensively in order to learn what has been done to check or prevent the smoke nuisance. If he has opportunity he will also interview the "smoke inspector" for his city and will examine at first hand the methods of measuring the density of smoke and the equipment used for improving combustion. For some time the facts which he gathers from various sources will exist chiefly as notes, suggestions, statistics, and more or less vaguely formed ideas. Then, gradually, he will analyze his material and think his way through to an orderly arrangement of the data. The final stage will be an explanation and an interpretation of the various phases of the subject, presented in the writer's own words and adapted to his reader and his purpose.

Although the subject matter of the typical "paper" is not, in the strictest sense, original, there is ample opportunity for the writer to show his originality in the treatment of his material. We are not considering, of course, the "paste-pot-and-shears" type of composition, in which the writer merely strings together a series of quoted or paraphrased discussions which he has borrowed from the most convenient source. In proportion as his investigation is thorough and includes not only printed discussions but first-hand sources of information he will be freed from the temptation to copy or appropriate directly the work of some one else. To be sure, he may find it advisable to quote some

passages in which an idea is particularly well stated, or in which the actual language of a recognized authority would add interest and impressiveness to the discussion. So long as he chooses the quotations with care, indicates their source, and works them smoothly into his own discussion, there can be no objection to his using a moderate amount of borrowed material. The main requirement is that the organization of the data, and the shaping and adapting of it, shall be his own. The reason why some discussions are condemned as "encyclopedia stuff" is not so much that their content is stale as that the handling of it is lifeless. In proportion as a writer has turned a subject over in his mind and has made it a part of himself, he will present it in an original, and most likely in an interesting, way.

There is a type of paper in which the writer's investigation of the subject is necessarily so far-reaching and his analysis so thorough as to make the result a highly original piece of writing, comparable to a thesis or monograph. A striking example of such a challenge to the writer's creative ability is found in the prize competition recently conducted by Bonbright & Company. The contestants were asked to write a review and a forecast summarizing the progress of the electric light and power industry for the decade 1920-1930. The only stipulation regarding the form and content was that the manuscripts should meet the conditions set forth in the following editorial note:

This article by presents in a clear and concise manner the story of the electric industry during the past ten years. It covers briefly the field of power and light operations and traces the modifications and improvements in the generation, distribution and merchandising of electricity, as well as outlining the progress made in such important phases of the industry as public relations and financing methods. Written in terms intelligible to all who are interested in the industry, this article constitutes an absorbing story as well as an illuminating report.

Prizes aggregating \$10,000 were offered by Bonbright & Company, to be awarded on May 18, 1925, and an additional prize of \$10,000 was authorized by the American Superpower Corporation, to be awarded to the contestant whose paper, reviewed again in 1930, should prove to have been the most accurate prophecy.

It is evident that the preparation of such a paper is chiefly a problem in analysis. All the contestants would have access to practically the same information. The difference would be in their classification, interpretation, and presentation of the material. By permission of the author, Mr. John Dockendorfer, the outline for one of the prize-winning papers⁴ is reproduced below. It will be noted incidentally that Mr. Dockendorfer has used the "table-of-contents" form effectively to indicate his analysis of a particularly difficult subject.

TABLE OF CONTENTS

INTRODUCTION

IMPROVEMENTS IN PHYSICAL UNITS

Pulverized Fuel—Coal Distillation—Higher Steam Pressures—Higher Degrees of Super-heat—Hydro-Electric Developments—Muscle Shoals—Automatic Plants—High Voltage Transmission—The Transverter—Oxide Film Lightning Arrester.

INTERCONNECTION

Super-Power—Giant Power—Efforts of Individual Companies.

FINANCING

Capital Invested—Stock Sales Through Customer Ownership Campaigns—Yield of Electric Service Bonds and Stocks.

OPERATION

Population and Customer Growth—Connected Load—Installed Capacity, Fuel and Hydro-Electric Consumption, Lighting, Power, Electric Railways—Reduction in Line Losses—Energy Generation, Fuel and Hydro—Additions to Transmission and Distribution Systems—Operating Results, Revenues, Expenses, Return on Invested Capital.

⁴Mr. Dockendorfer's paper was selected for the third prize.

MARKETS

Domestic—Power—Industrial Heating—Electric Railways—
Battery Charging—Rural Service.

MERCHANDISING

Household Appliances—Easy Terms to Purchasers—Lamp Re-
newal Policies—Value of Merchandise and Supplies Sold—
Value of Household Appliance Sales.

EMPLOYEE RELATIONS

Educational Work Among Employees—Bonus Systems—Re-
lief Work and Pension Systems.

LEGISLATION

Federal Water Power Act—Municipal Ownership—Extent of
State Regulation—Policy Concerning Property Values and
Rate of Return—Trend Toward Leniency in Regulation.

PUBLIC RELATIONS

Use of Advertising Media—Customer Ownership Campaigns
—Voluntary Rate Reductions—Service-at-cost Contracts.

SOCIAL ASPECTS

Effect of Electric Service on Factory Employee, on Cost of
Manufactured Product—Cost of Electric Service and Cost of
Living—Electric Service Applied to Rural Use—Electric
Service and Health Improvement—Effect of Electric Service on
Standards of Living.

In the development of a paper there is excellent opportunity for the student to gain experience in the writing of semi-technical or popular scientific style. More of the interest of such a discussion may be in its presentation than in its subject matter. A dull or heavy style can render flat and boresome an intrinsically interesting subject. On the other hand, an apparently unpromising subject may be enlivened by skillful treatment.⁵ First in the organization, and later in the style, the writer finds opportunity to impart originality to a discussion made up of borrowed material. In general the same strain of originality and independ-

⁵ For an example of a paper in which scientific facts are made interesting, the student is referred to the article "Physics and Civilization" by Arthur D. Little in *The Atlantic Monthly* for July, 1924.

ence is evident throughout. The writer who has the daring to arrange his subject matter in new combinations will probably have the courage to express his ideas in language that is entirely his own. If he has any degree of literary skill, the resulting composition will have both distinctiveness and interest.

GRAPHIC METHODS OF PRESENTING DATA

Practically every kind of written work done by the technical student calls for the use of graphs as an auxiliary form of expression. Even in a purely mechanical sense there is an advantage in supplementing the text of a composition with an occasional graph. It is a means of giving variety to what might easily become a monotonous expanse of type. For subjects which do not lend themselves readily to illustration, the graph provides welcome relief from the apparently formidable solidity of an unbroken text. An illustrated treatise on economics, for example, is unthinkable; but writers on economics make effective use of graphic methods in the presentation of statistical material.

It is not enough to say that some ideas are better expressed when put in graphic form than when stated in connected discourse. As we have seen in the discussion of statistical style (p. 155 ff.), the writer does not really have a choice in the matter. He must use the graphic form for clearness as well as for variety. Especially if his purpose is to show a comparison of numerical data which undergo a changing relationship he is obliged to translate the facts into the language of graphic statement.

The basis of graphic expression is gained by the student early in his course in connection with the curves which he prepares for his scientific studies. He learns that in mathematics, physics, and other fundamental subjects, certain kinds of ideas can be represented clearly and effectively by

means of a few simple lines, whereas the same ideas could hardly be made intelligible if columns of figures or paragraphs of text were used instead. The following condensed version of rules given by a science department⁶ indicates the principal requirements for the construction of graphs:

THE CONSTRUCTION OF GRAPHS

In the construction of graphs, as in the making of maps, great care must be used if the graphs are to have any real value. The worthlessness of a map not carefully drawn to scale, or not labeled so as to give all information concerning the section it represents, is obvious. Exactly the same is true of graphs. In drawing graphs, the student should carefully observe these two essential rules:

(1) *The finished curve should show as accurately as possible the relation between the variables plotted.*

(2) *The relation between the variables should be made as clear as possible.*

As a means toward these results the suggestions given below may be followed to advantage. (Curve sheets 1 and 2 are given to illustrate the general use of graphs. Curve sheet 3 is given to illustrate the several suggestions which follow. Reference to it will help to make clear the suggestions.)

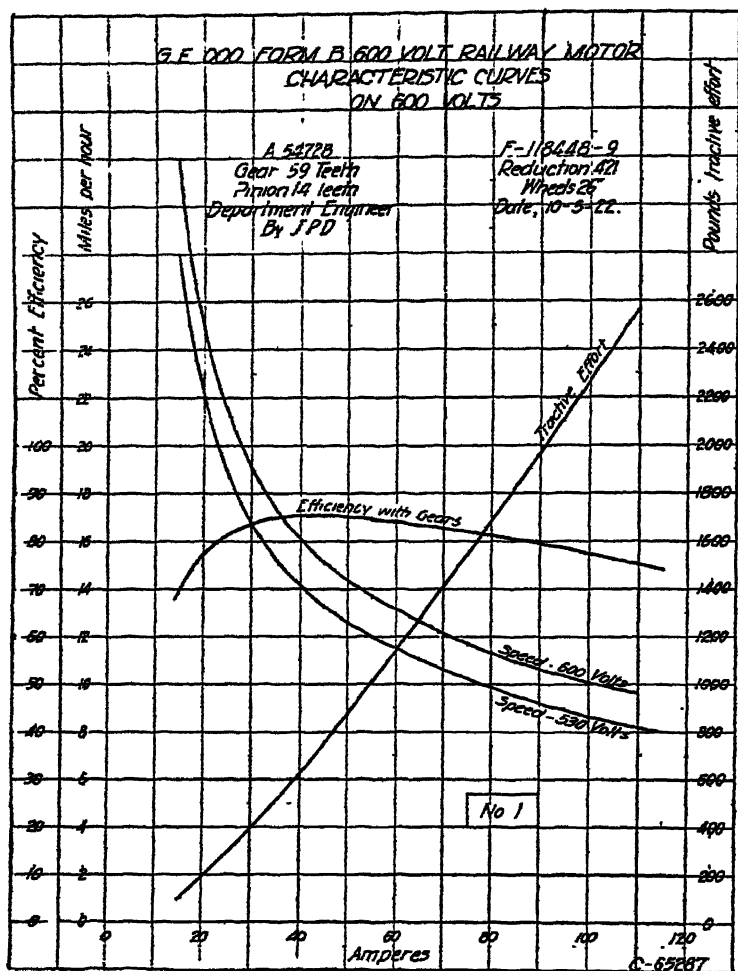
Choosing the position of axes and the scale lengths. Obviously, the first thing to do in the construction of a graph is to choose the position of the axes. In choosing the position of the axes, it is well to bear in mind that the independent variable should be plotted as the abscissa. This is general practice and is illustrated by the following. In plotting the distance covered by a falling body as a function of time (represented by the equations $\frac{1}{2}gt^2$), we assign certain independent values to "t" and determine "s." Therefore "t" is the independent variable and should be plotted as the abscissa. In performing an experiment one will always know which variable is independent and which is dependent.

Always lay off axes at least two centimeters from the bottom and left side of the co-ordinate portion of the paper. This makes for neatness and leaves room on the outside of the axes for proper

⁶ From *The Construction of Graphs*, by D. A. Wells, Instructor in Physics, College of Engineering and Commerce, University of Cincinnati.

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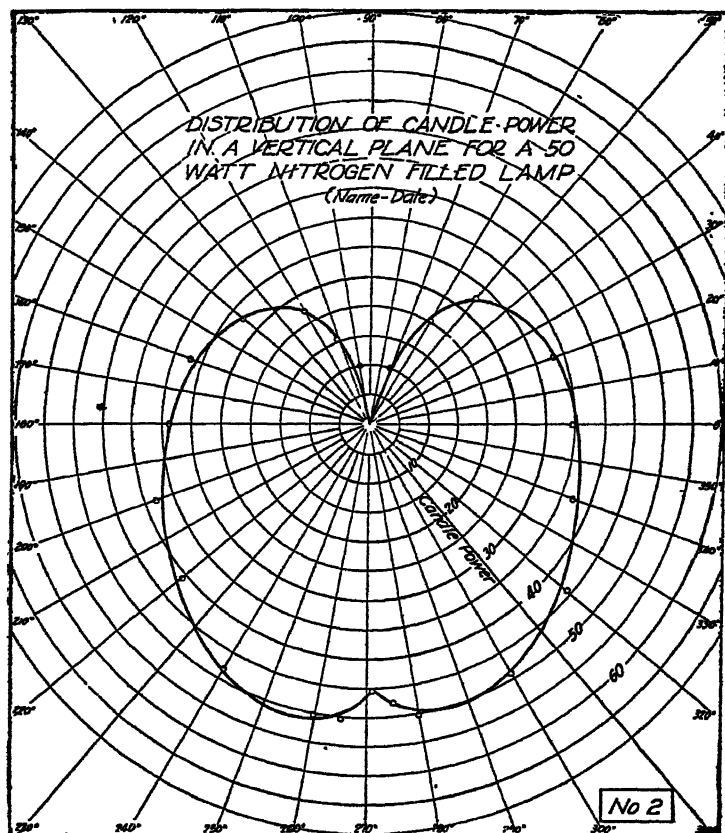
divisions and labeling. It is rarely necessary to lay off axes along the edge of the co-ordinate section, and this should be avoided when possible.



Having located the axes, choose the units of each axis so that the curve will cover the sheet as nearly as possible. Such units should generally be chosen so that the curve will be approximately

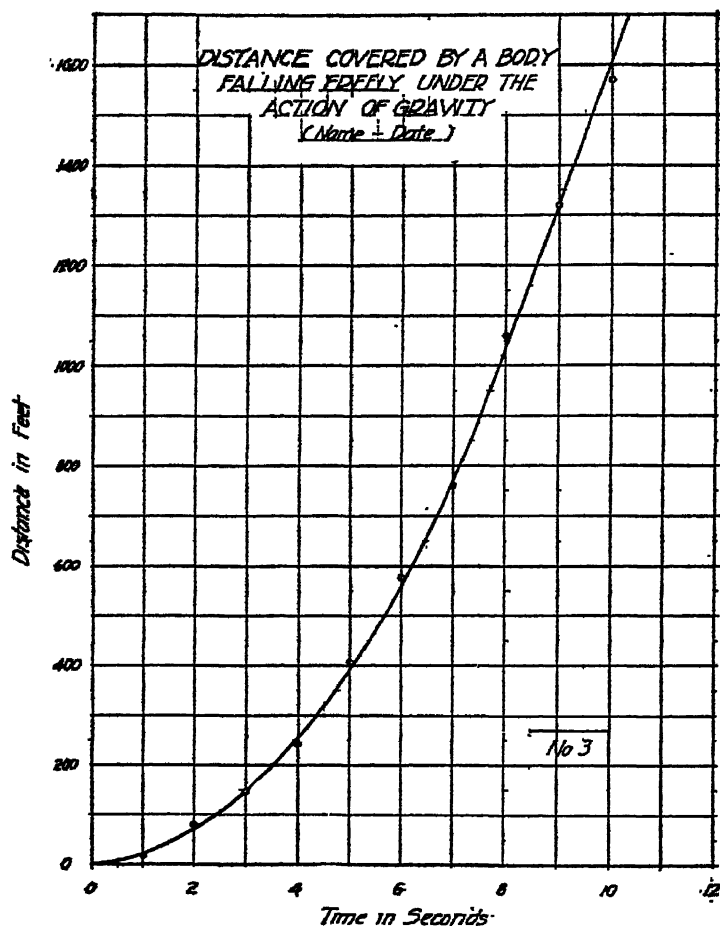
the same distance from either axis. There is no special advantage in using the same units for both axes, and in many cases it is impossible to do so and get the curve on a sheet of ordinary size.

When only a limited range of a variable is of interest, it is often convenient to start the divisions of the axis not at zero but at the lowest values to be represented by the graph.



Making the divisions, labeling the axes, and plotting the curves. Indicate at regular intervals of about two centimeters (not less) the scale of each axis. Figures indicating a scale should never be printed so near the axis as to touch it. Keep a distance between them of about two millimeters.

It is very important that the user of a graph should know at a glance what each axis represents. *Therefore, carefully label each axis so that this point is clear. The label should be neatly lettered in, the ordinate being lettered so that it reads from the bottom to the top.* These letters should have good clearance from the numerals indicating the divisions.



Having properly divided and labeled the axes, plot the observed or calculated values, *making a small circle around each point plotted.*

This is not always done in general engineering practice, as will be seen from the motor curves of the General Electric Company, the reason being that in the large industries curves are taken by experienced men rather than students who are just learning to draw graphs, and too, in most industrial problems, it is the average curve that is of importance rather than the individual points. However, in elementary laboratory and research work, a small circle around each point should always be used to mark the observed points. It is often true that not all observed points fall on a smooth curve, and it is always of interest, in the work mentioned above, to know just where these observed points fall with respect to the smooth curve drawn for them. By the use of small circles, as suggested, this is clearly shown.

With a ruler or French curve draw a smooth curve so that it strikes as close an average between all points as possible. Never draw free-hand curves; they are worthless. Never draw a straight line from point to point, unless in doing so you get a perfectly uniform curve. Bear in mind that if all points do not fall on a smooth curve, it means an error in observation, and that a curve which is an average between all points will in general represent the change in the variables more accurately than will the observed points themselves.

In some part of the upper portion of the sheet, where there is ample room, *letter in the title of the curve and directly below that, your name and the date.* It is as obvious that a graph should be given a title as it is that a map should be given the title of the section which it represents. It is general engineering practice to record the name and date for future reference.

The first draft, lettering and inking. A satisfactory graph cannot be made without proper instruments. One need not expect to do acceptable work with a writing pen and blue-black ink. The necessary instruments are: a hard drawing pencil, a straight-edge or triangle, a French curve, an inking pen, an inking compass, a block of art gum, and a bottle of black drawing ink.

The first draft should always be in pencil. If any small error is made, the art gum will erase it, whereas if ink is used at first it is almost impossible to erase it neatly.

A standard form of lettering used largely in industries should be used in all graphical work. The exact height of letters and numerals will vary somewhat with the size and kind of graph paper

used, but in general *it is good practice to make capital letters and numerals three spaces high* (three of the smallest divisions of the co-ordinate portion) *and small letters two spaces high.*

After the first draft is completed, the entire work should be inked in. Use the triangle and the inking pen for the axes, which should be rather heavy. With the inking compass, ink in the small circles around the points. These circles should be very small, not more than about a millimeter inside diameter. With the triangle or French curve and the inking pen, draw a smooth curve so that it strikes as close an average between all points as possible. *Do not ink through the small circles.* Draw up to them, beginning again on the other side. It is often a little difficult to make a French curve exactly fit a graph but if a trial is made first with a pencil, and if the portion of the French curve is found that will fit, no trouble will be experienced when it comes to inking. The actual curve should never be a heavy line. The heavier the line the less accurate will be the readings taken from it. Make the curve as thin as it can be and still stand out prominently against the sheet.

Plotting more than one curve to a sheet. It is often convenient and desirable to plot more than one, or even several curves on the same sheet. A number of variables are often plotted as a function of a single variable, as in the case of graph sheet No. 1. When two or more curves are to be plotted on the same sheet, one of three things must be done to distinguish between them. First, each curve may be drawn with a different colored ink. This, however is not effective where blue prints are to be made. A second method is to draw all curves in black ink and label them separately, as in graph sheet No. 1. This is a very good method, especially for commercial work. Again, each curve may be drawn with a different type of line. For instance, the following lines may each represent a different curve.

Drawn line

Dash line

Dotted line

Dash-dotted line

When this method is used, a legend will of course be needed to show what each line represents.

A method often used in research work, is to make each curve a solid line but to use different characters to locate the observed

points. For example, a circle is used to locate points on one curve, a small square those on another, a triangle those on another, a cross in a fourth case, and so forth. A legend may then be made for these different characters.

It is evident that no general rule can be given which will apply in detail to all curves. It is therefore true in a large number of cases that the question of just what units to select, just where to draw the axes, and so forth, are matters for judgment.

Proficiency in drawing graphs comes through practice, but the lack of practice may be overcome in part by proper patience and regard for neatness. Neatness is one of the greatest contributors to both the essentials of a good graph, accuracy and clearness.

SEMI-TECHNICAL AND POPULAR GRAPHS

Just as the style of writing in a composition may vary from the strictly technical to the popular, the graphs used may be adapted to a variety of purposes and readers. When the writer wishes to appeal to a general reading public he can usually transform his graphic statement into pictorial terms without affecting its mathematical accuracy. Suppose, for example, a writer wishes to present for comparison a collection of data on the relative heating value of certain fuels. Instead of putting his data in tabular form, he may use a series of conventional thermometers, as in Figure 4. Or if he wishes to show the increase in the production of crude oil over a period of years, he may represent a series of derricks which vary in height according to the quantity of crude oil produced in each year. In this way the tops of the derricks correspond to the points on a simple curve, and since the longitudinal dimension is emphasized, the relationship is mathematically accurate enough for a popular graph. Incidentally, it is important that the pictorial treatment should stress the one dimension instead of the area or the cubic contents of the figures compared. A series of cylindrical oil tanks, for example, would be pictorially ap-

propriate, but the difference in height of the oil in them for the successive years would not be sufficiently marked to give a clear picture of the relative quantities of oil produced. A more accurate presentation could be made in terms of a

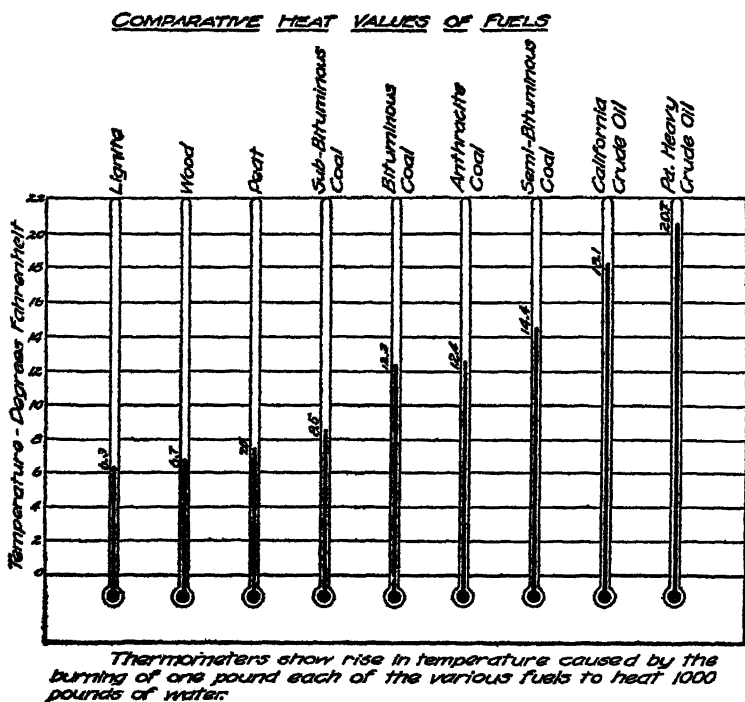


Fig. 4. Pictorial interpretation of a simple numerical relationship.

series of trains made up of small tank cars, though this device has been somewhat overworked.

In the construction of pictorial graphs, the student may find unlimited opportunity for the display of ingenuity. If a class enters into a contest of originality, the competition will not only have the interest of rivalry but will serve to illustrate the possibilities of graphic methods for expressing

facts. In one such contest the following were among the ideas suggested, together with their rating:

Appropriate and mathematically accurate, but lacking originality

a. Comparison of distance covered by telephone lines in the United States with that of other countries, England, France, Germany, and so on:—Rows of telephone poles are strung with wires, the United States being represented by the longest line, and the others by shorter lengths, according to their relative mileage of telephone wires.

(This graph illustrates the danger of choosing an obvious basis. Interest would be increased if an element of surprise were introduced, especially if the scheme proved to be a strikingly appropriate one that everybody but its originator had overlooked.)

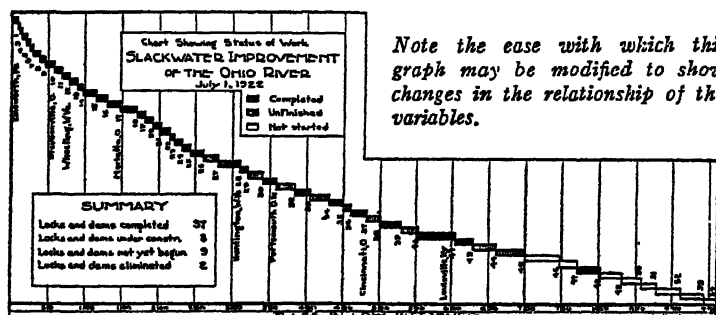


Fig. 5. *A graphic report of progress.*

Appropriate and somewhat more original

b. The consumption of cigarettes in the United States for each of several successive years:—A row of cigarettes is pictured having uniform length and size, each representing one year in the series. Each is shown to be smoked back to a point corresponding to the proportionate consumption of cigarettes for that particular year. Since the "ashes" represented at the smoked ends of the cigarettes have not been removed, the relative consumption for the various years is indicated as in the points of a curve by the lengths of the burned portions.

Still more original

c. The distribution of a student's day into time spent in study, recreation, and so on, is shown by the sector method, but the circle is converted into the dial of a conventional clock, so that not only the relative quantities of time but also the hours of the day for each part of the schedule are graphically shown.

d. The relative literacy of the population of various countries

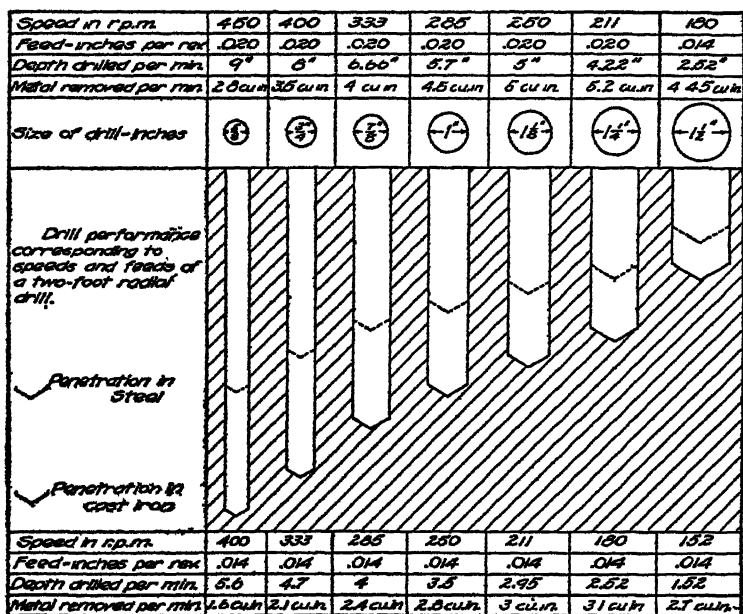


Fig. 6. Graphic presentation of data including many variables.

is shown by a series of piles of books, the highest pile representing the most literate country. The names of prominent authors for the various countries appear on the covers of the books.

Most original

e. The relative popularity of four-cylinder, six-cylinder, eight-cylinder, and twelve-cylinder automobiles, as shown by statistics of manufacture over a period of years, is represented on a sheet of cross-section paper. The rivalry of the different kinds takes the

form of a hill-climbing contest, each car following its own curve across the sheet. By this means, the loss or gain of a particular type is seen, as compared with changes in the position of the others and with its own former position. A conventional automobile bearing the appropriate number, 4, 6, and so on, marks the point for each year's production, and the paths of the several cars are differentiated by the use of broken lines of different forms for three of the four curves. A heavy solid line is used for the winning type.

A few typical examples of pictorial graphs made by members of English classes are given on pages 224-226. With these as suggestions the student should devise original graphs based on data with which he is familiar. There is no more fascinating game than "playing with statistics." A study of figures compiled on any industry or institution for a period of time will suggest comparisons and tendencies which will be worth plotting as curves and which will very likely form the basis of interesting adventures in pictorial representation.

Considerable stress has been laid on graphic methods, because of the universal need for this kind of expression to do what written language cannot do so well, or cannot do at all. As we have seen, the writer's first task is to decide which form of expression is best suited to his purpose. A judicious combination of text, photographs, and curves not only gives variety to the pages of his manuscript but also conveys more effectively the different kinds of ideas which he is called upon to express. In the selection of each medium, and especially in their combination, the writer will find outlet for his best creative ability.

ARTICLES FOR TECHNICAL JOURNALS

Every engineering student is potentially a contributor to one or more technical journals. Even if he does not chance upon suitable material for publication during his college

period, he will not be long in practice before his observation or experience will give him ideas which he will wish to share with other members of his profession. This assumption of future authorship suggests the desirability of student practice in writing for publication, or *as if* for publication.

This preliminary journalistic experience has more immediate advantages, however, which are sufficient in themselves to justify it as a part of the engineering student's training in English composition. By analyzing various articles in order to study their technique the student learns to classify them readily and to grasp their content easily. He learns where to look for general discussion and where for specific information, and he thus becomes able to collect and sift bibliography intelligently. By noting the emphasis on *timeliness*, *originality*, and *practical usefulness* in magazine articles he gains a better appreciation of their technical value, as well as a clearer notion of what would be an acceptable contribution from him.

From the standpoint of the teacher of composition, no better exercises could be found than a set of journalistic assignments. If the best models are followed, the student will have unexcelled opportunity to develop observation, a sense of proportion, variety of phrasing, and ability to write simple, clear, smooth, and straight-forward English. Best of all, his relation to his subject and audience will be the normal one of the writer who has something interesting to say and who has a definite motive for saying it effectively.

The importance of this last advantage will be made clearer by a brief consideration of the conventional and sometimes perfunctory thing called a "composition." The regulation composition is pretty certain to be of the discussion type; that is, it is a disquisition on some general topic, such as "Concrete Buildings," "Asphalt," "Submarines," "Colonial Architecture," "Scientific Management," "Elec-

tric Furnaces," "River-Improvement Work," and so on. As a "paper," such a discussion may be a profitable exercise, but as an article, even of the "discussion" type, it should not be attempted unless the writer has had first-hand contact with some phase of the subject.

The magazine editor, a part of whose business is to protect his public against uninteresting and unprofitable reading, has no use for vague and general discussions. On the other hand, the student who attempts to write on one of these topics must either deal in empty generalities or present a warmed-over rehash of some one else's discussion. In other words, he must simply assemble the ready-made parts into the most respectable unit he is able to make. As we have seen, this process of putting standard parts of a composition together is not without value, especially if care is used in selecting and fitting the pieces. There are even cases in which the material is completely re-wrought into what is virtually an original product. At best, however, it is something very different from the magazine editor's idea of an acceptable contribution.

The point to be emphasized is that the general discussion type of composition as it is often written is not a vital, nor in the best sense an original, exercise. It may be used where students are unable to find live material, but certainly it is a type of exercise that does not call for a great amount of alertness, originality, or first-hand observation on the part of the writer. The vagueness of the assignment and the consequent freedom of treatment may be a dangerous temptation for the inexperienced person, who may content himself with stringing words together.

Contrast with the dry, academic, general discussion type of writing a specific assignment for a real technical article. Instead of "Concrete Buildings" and *The Reader's Guide*, the student is given the following instructions:

(A)

Mr. _____, engineer for the _____ Construction Company, a local concern, has recently designed a new type of adjustable shore. Write an account of this invention in a crisp news article as if for publication in the (name of a technical journal). Include photographs or sketches. Restrict your article to 600 words or less.

Or, instead of the general topic "Asphalt," which would probably drive him to the *Encyclopædia Britannica*, the student is given some such suggestion as this:

(B)

The _____ Commission has just made a series of tests on a half mile of road paved with Kentucky rock asphalt. Give full details of the construction of this road and of the nature of the tests in an article for _____. Get photographs, curves, and tables of data. The article should not exceed 1500 words.

The foregoing typical assignments are specific problems in writing. Moreover they are definite, tangible and vital enough to arouse interest in both the writing and the reading. Still more interesting and beneficial are the projects which the student makes out and completes on his own initiative. Using assignments like (A) and (B) as suggestions, and following some models which have been studied in class, the student soon develops an "eye for copy" and is able to write a variety of articles from his immediate observation or experience.

Some of these articles may be actually published, but whether they are or not, the stages of their preparation are the same. The student gets a promising idea, decides upon the scope of a possible article, and tests his subject for the requirements of live interest and engineering value. Then by means of the *Engineering Index*, the *Industrial Arts In-*

dex, and the indices to the most likely magazines, he learns whether any articles have been written on the phase of the subject which he proposes to discuss. Finding that nothing has been published on the subject, and that his article will not therefore be a duplication of any previous one, he may proceed with the confidence that he is doing something new. The originality and engineering value of his idea may be further tested by the criticism of his fellow-students and his technical instructors.

The student is now ready to consider the type of article which he will write, the arrangement of his material, the points which he will feature or emphasize, the use he will make of photographs or sketches, and various other matters relating to the organization of his article. Examination of typical articles in the magazine for which his contribution is supposedly intended will enable him to judge the appropriate style and method of treatment for his particular article. By giving careful attention to all these preliminary matters he will have greatly simplified the actual writing process. As a rule, however, he will find it necessary to revise his first draft, and especially to work over his beginning to make it clear and direct, for long and formal introductions, of course, are entirely out of place in an article of this kind.

After he has fully revised the manuscript, has omitted unnecessary passages, and has smoothed the rough places, he is ready to put the article in proper mechanical condition. If he cannot typewrite it himself, he should see to it that the copy which the stenographer receives is legibly written and correct, and he should give explicit instructions as to spacing, centering, and other details which will improve the appearance of the manuscript.

To follow an article through these various stages to its completion is by no means an easy task, but the student

realizes that it is a profitable one, and because it is in all respects his own work he may well take interest and pride in seeing that it is properly done. Many short articles are much easier to prepare than would be suggested by the foregoing outline, but whether the successive steps are taken rapidly or slowly, all these matters should be given attention. There is nothing better for developing mental alertness and skill in writing than the rapid preparation of a variety of articles. It is more than a coincidence that a large proportion of literary men have served some kind of journalistic apprenticeship.

Without entering upon a minute classification of technical articles, we may note, in passing, the principal types and their relative importance to the young writer. Omitting the brief section at news notes, the articles which make up the body of the average technical magazine may be grouped under three heads: discussion, report, and descriptive articles. The first of these includes editorials and letters expressing opinion, but refers chiefly to articles on general subjects, the style and treatment of which may vary according to the author's discretion. Discussions of articles by persons of long experience, mature judgment, and known general fitness to deal with a subject are always in demand, and properly so. Likewise, editorials and signed letters of opinion in the more prominent journals may be safely assumed to be thoughtful, suggestive, carefully reasoned articles. Except as an exercise, however, the discussion type of article should hardly be attempted by the beginner. He is not in a position to write editorials, unless for his college paper, and his sense of proportion will probably restrain him from offering either letters of opinion or long discussions as contributions to a technical journal.

The report type of article, though less common than the others, deserves special notice because of its scientific char-

acter. In form it resembles the reports of laboratory tests which students are often called upon to make. That is, it consists of a statement of the object of an investigation; the theory on which the tests were made; the apparatus used; the procedure; the results, shown in tabulated form; and the conclusions reached. This kind of article is usually technical in language and is addressed particularly to persons who have a considerable background of technical knowledge. The data constitute its chief interest, and the written part is intended merely to state the purpose, vindicate the method, and explain the conclusions of the investigation. Because the writer must adhere rigidly to this outline, the report type of article is an excellent exercise in logical arrangement and clear, concise statement. Students are sometimes in a position to write a report article; but as a rule, the actual preparation of such articles for publication is done chiefly by older men who have specialized in some phase of engineering research.

By far the most in demand is the descriptive type of article. Dealing as it does with a specific subject of timely interest, it constitutes a kind of technical reporting, in which the details are selected and presented according to the interest of a given body of readers. A large proportion of the articles, particularly in the weekly technical journals, belong to the class of news stories which feature novel methods or equipment or the solution of difficult practical problems in engineering. These descriptive articles, as indicated in assignments (A) and (B) above, are written in a smooth, brisk, newsy style, and much of the thought is expressed in terms of significant photographs and sketches.

It is in the writing of such specific articles, especially in the short ones which deal with new "kinks" in engineering practice, that the beginner finds his best opportunity. A new method of locating trouble in the repair of electrical ap-

paratus, a novel design for a foundry pattern, a device for hoisting materials on construction work—these are only a few suggestions of the sort of material which is most easily obtained and of the kind of articles most in demand. Since one of these brief descriptive sketches, if well written, has all the requisites of a longer article, the student's experience in technical journalism may well center about such assignments.

CHAPTER X

THE USE OF THE LIBRARY

AMONG the chief benefits to be derived from a college course is the acquisition of "the library habit." Indeed, the opinion is sometimes expressed that the student has more to gain from the college library than from the college classroom. Dr. Johnson meant something like this when he said, in commenting upon the lecture system: "I cannot see that lectures can do so much good as reading the books from which the lectures are taken." Stephen Leacock apparently wished to convey the same idea when he declared, with avowed seriousness, that if he were founding a university, his next concern after providing a smoking room would be to found a library, and that only then, if he had money left, would he hire a few professors. Thomas Carlyle, whose seriousness may be taken for granted, emphasized the importance of the library in his oft-quoted statement: "The true University . . . is a collection of books." Woodrow Wilson's version of the same thought is in itself a compactly phrased philosophy of education:

You can't educate a man; he must educate himself, and the way he must do it is by reading. The most you can do is to direct his reading.

It is no disparagement of the teacher's work to say that in many respects Dr. Johnson and the others were right. Most teachers recognize the possibilities of the library and encourage a maximum of independent investigation by the student. In so doing they lay the surest foundation for the student's future development. The college graduate

who has done sufficient reading and investigating to acquire the library habit has gained the resourcefulness and self-reliance which are essential to mature scholarship. At the same time, he has made sound preparation for the research work which he will be called upon to undertake in the practice of his profession.

Perhaps the library is most appreciated for its aid in supporting the memory. Every one finds that he must determine, as early as possible in his educational career, what knowledge he shall try to remember and carry about with him, and what knowledge he shall merely know where to get. Since our memories are not entirely subject to our wills, the average person, try as he may, cannot hope to become a walking encyclopedia. Nor need he be discouraged by his inability to retain a vast quantity of miscellaneous information. To recall the exact population of the thirteenth largest city in the United States as given by the census of 1900, is an impressive feat, but the person who can do it is not necessarily to be envied. Far less enviable, of course, is the extreme opposite—the type of person who has only a vague impression that something important happened in either 1492 or 1429; whose retentive power is either lacking or undeveloped. The student who makes the best use of his brain cells is the one who, avoiding both extremes, depends upon reference works for detached bits of information and concentrates upon the memorizing of related facts, with due regard for their significance.

For one who exercises this discrimination the library serves a twofold purpose. It relieves him of the task of memorizing isolated details, and it fortifies and extends his knowledge of important relationships between historical or scientific facts. He recognizes, for example, the importance of knowing the answers to such questions as "When did Faraday live, and what did he contribute to science? To

what earlier scientists was he indebted? Who continued his work, and with what results?" With a chain of chronology and causation as a center, the various names and dates and facts fall naturally into their proper relationships. They are not only more worth remembering on this account; they are also more easily remembered, because they are definitely associated and because they help to explain one another.

Whether the object of inquiry is an isolated fact or a group of associated details, the library affords a short cut to the source of information. For this reason the modern library is a great deal more than a collection of books. Even if it were simply a repository of information, the student would gain much by browsing through its volumes. Its usefulness is greatly increased by the fact that in addition to being a storehouse of knowledge it is also an organization for reaching any part of that knowledge quickly and surely.

If the information wanted is to be found in books, the card catalogue of the library is first consulted. By a simple principle of alphabetical or numerical sequence, or rather by a combination of the two, a book dealing with almost any subject may readily be located. When the author of the book is known, it is merely a question of turning to his name in the alphabetical index of authors. If, as more often happens, the investigation begins with the subject, the process is not quite so simple.

CLASSIFICATION BY SUBJECT

To illustrate, let us assume that we are to look up the subject "Adiabatic expansion in steam turbines" and make a report on it. (It is hoped that this topic is sufficiently unfamiliar to serve as a typical example.) We know, of

course, that we shall have to depend upon the subject index, and we are fairly certain that "adiabatic expansion" is too specific to be found among the guide headings on the cards, since it is only a special phase of a larger subject. A more promising approach is through the general heading "Steam Turbines." By alphabetical sequence, we locate it among the guide headings and find a collection of cards representing books on the subject. Without examining the books themselves we can learn a great deal about them from the cards. Finally we select one which, because of its recency and its apparent comprehensiveness, gives promise of containing the discussion we are seeking. The card catalogue describes it as follows:

621.165

M938s4

STEAM

STEAM TURBINES

Moyer, James Ambrose, 1875—

Steam turbines; a practical and theoretical treatise for engineers and students, including a discussion of the gas turbine, by James Ambrose Moyer. . . . 4th edition, rev. and enl. New York, T. Wiley & Sons, inc.; 1919.

xi 496 p. illus., fold. chart (in pocket) diagrs. 23½ cm.
\$4.00

It is the work of a moment to copy the call number (621.165, etc.) and by its aid to locate the book on the shelves. Then, by means of the index in the book, we find on pages 21-24 the complete explanation that we started out to get.

The foregoing summary is a "slow motion picture" of a process which can be carried out very rapidly after a little practice, and which must appear quite elementary and obvious, once it is described. A more difficult case for investigation is one in which the subject is specific, unfamiliar,

and isolated, without any accompanying information to suggest a general heading. Suppose, for example, that the topic used above had been simply "adiabatic expansion" without the clue "steam turbines." Some preliminary detective work in the dictionaries and encyclopedias would then have been necessary. As a rule, of course, an isolated topic does not come to one out of a clear sky. Unless it occurs in an information test or something of the kind, the special subject is already associated with a general topic that can be found among the guide headings in the card catalogue.

Typical subject headings. A few specimen subject headings, or "range finders," taken from a library of 6,000 volumes are given below. Note that these headings lie midway between the broad, general subject groups into which books are classified and the special topics with which an investigation commonly begins.

- Accounting
- Administration
- Advertising
- Aerial Navigation
- Agriculture
- American Bureau of Shipping
- Arbitration, Industrial
- Argentine Republic
- Artillery
- Atomic Theory

(Cross-references on the same subject appear under Electrons and Ions.)

The Dewey Decimal System. The library system of classification may best be explained through an interpretation of the call number of a book; for example, 621.165, applied to "Steam Turbines." The system thus indicated, which is followed in most American libraries, is known as the "Dewey Decimal System," from its originator, Mr. Melvil Dewey, of the New York State Library. It is built

on a classification of the whole field of knowledge into nine main divisions, represented by the digits from 1 to 9. A tenth group, represented by 0, is reserved for general works. Each main division is subdivided into nine main branches, each of which is likewise subdivided, and so on, until the subclassification has become sufficiently minute. The following examples will suffice to illustrate the general method:

0 General Works	600 Useful Arts (General Works)
1 Philosophy	610 Medicine
2 Religion	620 <i>Engineering</i>
3 Sociology	630 Agriculture
4 Philology	640 Domestic Economy
5 Natural Science	650 Communication and Commerce
6 <i>Useful Arts</i>	660 Chemical Trades
7 Fine Arts	670 Manufactures
8 Literature	680 Mechanical Trades
9 History	690 Building

A further subdivision of Engineering may be cited far enough to account for the third digit in the call number (621.165) applied to a book on "Steam Power Plant Engineering."

620 Engineering (General Works)
621 *Mechanical Engineering*

Taking the digits separately, then,

6—Useful Arts
2—Engineering, a branch of Useful Arts
1—Mechanical, a branch of Engineering

The figures 165, beyond the decimal point, represent a like sequence of subdivisions under Mechanical Engineering. For example, .1 refers to "steam." Since we are not concerned with the specific problems of the cataloguer, but only with an explanation of the general scheme of grouping books, we may take the latter part of the classification for granted. Any one who cares to do so may find a complete

list of subdivisions for this and other engineering classifications in a Dewey library manual. To some extent the Dewey system is being supplanted by the Library of Congress classification, in which alphabetical symbols are assigned arbitrarily to the major divisions and subdivisions. For example, *science*, corresponding to the 500 group, is represented by the letter "Q," and *technology*, corresponding to the 600 or "Useful Arts" group, is represented by "T." Major subdivisions are indicated by the addition of a second letter, for example, "QA" for *Mathematics*, "TJ" for *Mechanical Engineering*, and so on.

The peculiar difficulties which have confronted cataloguers of technical books, even with so elastic a plan as the Dewey system, are explained largely by the rapid growth of engineering. For instance, when the system was first put in practice, in 1873, electrical engineering as such had not yet come into existence. Some of the older books relating to this subject were therefore classified in the 500 group; that is, Natural Science, Physics, Electricity. There are many possible cases of overlapping between pure science and applied science, designated respectively as "Natural Science" and "Useful Arts." On the other hand, a fixed subject like "Geometry" presents a simple problem of classification. It remains reliably 513; that is,

500—Natural Science

510—Mathematics, under Natural Science

513—Geometry, under Mathematics

Notwithstanding the need for certain special adaptations, the decimal system has proved highly efficient. Unlike the earlier library catalogues, which were printed, and were therefore out of date before they left the press, the card catalogue using the decimal system is always complete, though never finished. Even the card, already printed, is generally obtainable direct from the Library of Congress.

Then, after a few details have been added, it is simply a question of placing the new card between two others in the file, and, correspondingly, a new book on the shelves. The investigator who consults either the card catalogue or the shelves has only to follow the general scheme of subject classification in order to make the resources of the library his own.

REFERENCE SOURCES FOR PERIODICAL LITERATURE

Much of the information sought by technical students is too recent to be found in books, and must therefore be obtained from periodicals. In engineering and other applied sciences there is constant and rapid development of new materials, new methods, and new theories. To keep pace with the progress made, even in a single branch of the technical field, one must be familiar with the contents of a bewildering number and variety of publications. Thanks to the library, which provides a subject classification similar to that used for books, one can take the short cut to current information. A classification of the contents of periodicals is found in several reference works which should be familiar to every student.

The Engineering Index is published monthly and annually by The American Society of Mechanical Engineers. The monthly numbers are issued as a part of *Mechanical Engineering*, the Society's official publication. The annual numbers are published in book form.

The Engineering Index. *The Engineering Index* contains a subject classification of articles drawn from more than six hundred trade and technical publications. Main subject headings, like "Airplanes," are arranged alphabetically, as are also subdivisions under them; for example, "Barling Bomber," "De Havilland," and "Wings," under

"Airplanes." In addition to the title, author, and publication, with volume, number, page limits, and date, a brief description of the content of each article is given. Thus:

(Electric Railways, *main heading*)

(Cost Statistics, *subheading*)

Statistical Data on Electrified Railroads, W. D. Bearce.
Electric Traction, Vol. 19, No. 3, Mar. 1923, pp. 113-116.
Comparison of cost of operation by steam and electric
equipment.

Among the periodicals reviewed are some which are published in French, German, Italian, and other foreign languages. Through the Engineering Societies Library, of 29 West Thirty-ninth Street, New York, photostat copies of any article listed in the Engineering Index may be obtained, or translations may be ordered.

The Industrial Arts Index. A somewhat different field is covered by the *Industrial Arts Index*, which is published by the H. W. Wilson Company, of New York City. This reference publication, which is issued in monthly, quarterly, and annual numbers, provides an alphabetical subject index of current articles not only on engineering in general but also on architecture, manufacturing, management, labor, business, education, finance, and other divisions of practical knowledge.

The Readers' Guide. Articles on literature, art, politics, sociology, religion, economics, and other matters of general interest may be found by subject index in *The Readers' Guide* and *The Readers' Guide Supplement*, which are also published by the H. W. Wilson Company. *The Readers' Guide* indexes general periodical literature from 1900 to the present. Articles which appeared before 1900 may be located through *Poole's Index*, which covers the period from 1802 to 1906.

Abstracts. For some fields of science, such as chemis-

try, physics, and electrical engineering, articles may be investigated through abstracts. An abstract, which is a comprehensive summary of the original article, includes reproductions of significant formulas, drawings, or tables. Typical publications which review periodical literature in this way are, *Chemical Abstracts* and *Science Abstracts*. A specimen abstract from the latter publication is quoted on page 193. Especially if the original article is written in a foreign language, or if the magazine containing it is inaccessible, the abstract serves a useful purpose. If only a general notion of the content is needed, the reading of an abstract is a time-saving substitute for the reading of the complete article.

Reviews. Through reviews published in the various magazines, information may be obtained on current technical books. Signed reviews that are written by specialists are particularly helpful, since they give not only a summary of a book's contents but also an appraisal of its worth. By turning regularly to the review section of certain magazines the student is able to determine which of the new books he will probably find it worth his while to obtain. In addition, at a minimum expenditure of effort, he can learn enough about new books in general to keep abreast of the times. A few representative magazines which publish reviews are the following:

- American Economic Review
- American Historical Review
- American Political Science Review
- American Machinist
- A. I. E. E. Journal
- Atlantic Monthly
- Aviation
- Bookman
- Book Review Digest
- Compressed Air

Engineering News-Record
Forum
Machine Design
Machinery
Mechanical Engineering
New York Times Book Review
Quarterly Journal of Economics
Journal of Political Economy
Political Science Quarterly
S. A. E. Journal
Saturday Review of Literature
Survey
Yale Review

COLLECTING AND EVALUATING BIBLIOGRAPHY

The preparation of a "paper," a report, or a magazine article calls for a thorough investigation of books and periodicals dealing with the proposed subject. A "paper," though sometimes based in part on the writer's experience, is often made up entirely of material that has been obtained from printed sources. Even so, there is opportunity for resourcefulness and originality in the carrying forward of the investigation as well as in the subsequent organization of data. Sometimes an interesting problem of cross-references is encountered which calls for a certain amount of detective work. The question of whether the investigation has been sufficiently extensive is always present. The answer depends partly on the investigator's access to reference sources, but more, perhaps, on his conscience and his interest in the subject. Even though his report or article is based on first-hand data and is believed to be entirely original in content or treatment, the writer should examine all printed matter which comes within the scope of his discussion. If he finds no similar writings he will have the very considerable satisfaction of establishing his priority.

On the other hand, he may find that some one has anticipated his handling of the subject so completely as to make his own contribution superfluous. If the discussion is a thesis or a similarly ambitious form of monograph, a bibliography is important evidence of the compiler's fitness to deal with the subject. At the same time, it is an indispensable aid to readers who wish to do some investigating for themselves.

To cite a fairly simple case, let us assume the preparation of a paper on "Air Conditioning for Residences." This is a timely subject suggesting a report or discussion of perhaps twelve or fifteen pages. The general topic of "Air Conditioning" would be too vague or too large in scope for a typical paper. The title as given above indicates that there is not to be an extensive discussion of general principles. At the same time it excludes a number of specific problems in air conditioning, such as, for example, theatres, railway passenger coaches, hospitals, printing plants, or textile mills. Any one of these aspects of the subject would furnish material for a separate paper. Part of the investigator's task in collecting bibliography is to eliminate references to these other phases of the subject. In his preliminary survey he may wish to include a few general articles as a means of giving him perspective on the subject as a whole, but in the main he will choose only titles which are closely related to his particular topic. Further information concerning an article's content and treatment may be found in the brief statement accompanying each title in the *Engineering Index* (see Carrier, W. H., below), or if the article has been discovered through one of the Abstract magazines its subject matter will be fully indicated.

The following tentative bibliography contains a rather miscellaneous group of references, as tested by the specific subject, "Air Conditioning for Residences." Some of the

titles suggest an editorial or perhaps a summarizing treatment of "Air Conditioning" in general; others indicate a specific but rather abstract discussion of underlying principles; still others seem to be closely related to the particular topic chosen for investigation. In distinguishing this last group from the rest, the student will be following the usual procedure in selecting references.

AIR CONDITIONING FOR RESIDENCES

A Tentative Bibliography

(The sources used for the references are shown at the left.)

Anderson, S. M.: "Air Conditioning for Homes—Cooling."
(*Industrial Heating, Piping and Air Conditioning.* 3: 410-413.
Arts Index) May '31

Barnum, M. C.: "Effects of Too Dry Air."
(*Engineering Heating and Ventilating.* Vol. 17, No. 6, pp. 82-84,
Index) June, 1930

Carrier, W. H.: "Air Conditioning for Summer and Winter Comfort."
(*Engineering Heating, Piping and Air Conditioning.* Vol. 2, No. 9,
Index) pp. 783-787, Sept., 1930

Air conditioning for human health, comfort and efficiency; trends of development in this art, with possibilities of future; present state of ventilation research. Paper presented before the American Society of Heating and Ventilating Engineers.

Fisher, H. T.: "Country House; Heating and Air Conditioning."
(*Readers' Architectural Record.* 68: 372-383, Nov., '30
Guide)

Harbula, M. G.: "Air Quantities and Recirculation in Air Conditioning."
(*Industrial Heating and Ventilating.* 28: 65-70, Dec., '31
Arts Index)

Kratz, A. P.: "Humidification for Residences."
(*Industrial Domestic Engineering.* 137: 28-30, Dec. 26, '31
Arts Index) (Located under cross-reference, Humidification)

Kyle, W. J.: "This Air-Conditioning Business."
(*Industrial Electrical World.* 99: 90-91, Jan. 9, '32
Arts Index)

248 ENGLISH APPLIED IN TECHNICAL WRITING

McClure, B. C.: "Humidity in the Home."

(*Readers' Country Life*. 58: 104 Sept., '30
Guide)

Sewell, H. R.: "Home Air Conditioning; Its Problem and Possibilities."

(*Industrial Arts Index*) *Domestic Engineering*. 138: 21-23, Jan. 23, '32

Stangle, W. H., and Cherne, R. E.: "Air Conditioning Apparatus."
(*Industrial Heating and Ventilating*. Vol. 28, Nos. 7 and 10,
Arts Index) pp. 84-91, July, '31, and pp. 70-74, Oct., '31

However rapidly the preliminary appraisal of references is carried on, several tests should be applied to each article considered. These may be noted briefly in the order in which they appear in the typical bibliography.

1. THE AUTHOR'S NAME. As a rule, only signed articles will be included. An unsigned article is probably an editorial or a brief routine treatment of the subject. The value of a signed article may often be estimated from the author's reputation for knowledge and achievement in his field. A few men, for example, have become known for their interest in "Air Conditioning" and for their contributions to the literature of the subject. The same is true of every other field of knowledge. The investigator soon learns the importance of certain names, and though he does not pass over unfamiliar ones he looks for the established ones in particular. Of course the mere fact that an article has an identified author is to some extent reassuring, since it shows that some one assumes responsibility for what is said.

2. THE TITLE. As we have seen above, much may be learned from the title concerning the scope and probable usefulness of an article. Sometimes the author's point of view or even the spirit and style in which an article is written may be inferred from the title. Note the flavor, for example, of "This Air Conditioning Business" and contrast it with the matter-of-fact titles which suggest a less personal handling of the subject. On the whole, the title is a fairly accurate guide to the content and treatment to be found in the article itself.

3. THE MAGAZINE. Without making invidious comparisons we may note that some magazines are more worth-while than others as reference sources for a particular investigation. A subject like

"Air Conditioning" may be treated in various popular magazines for its news value, its human interest or its supposed business significance, rather than for the sake of its scientific or its more solidly economic aspects. Such popular articles may have a wide appeal but they are hardly appropriate for inclusion in a selected bibliography. The public for which a magazine is intended, and the recognized purpose and policy of the publication may be readily ascertained. Other things being equal, the type of magazine may determine the inclusion or rejection of a particular reference.

4. THE LENGTH OF THE ARTICLE. From a glance at the page limits of an article one can estimate the amount of detail which it is likely to contain. Most signed articles are fairly long, unless they are special contributions, such as "Shop Kinks," or "Field and Office Notes." An article covering several pages may be assumed to treat the subject in a detailed, descriptive manner and consequently to yield a fair amount of specific information.

5. THE DATE. Most subjects chosen for investigation are of current interest. They represent swiftly changing, developing ideas, mechanisms, or processes. For some subjects, of course, the historical method of treatment is necessary, and then a chronological arrangement of references becomes important. In general, however, the latest references are best. An article may be located if only the volume number and page are given, but the date both identifies the reference and indicates its desirability.

Too much emphasis cannot be placed on clearness of arrangement for bibliography and upon completeness and accuracy in the inclusion of such details as volume, number, page, and date. If unsigned articles are included, they should be arranged alphabetically according to titles. References to books should include the author, the title, the place of publication, the publisher's name, and the date, as in the following example:

Nash, L. R.: *The Economics of Public Utilities*, New York: McGraw-Hill, 1931.

Uniform arrangement and punctuation not only makes the bibliography more pleasing and useful; it also bespeaks the accuracy and reliability of the compiler.

GENERAL REFERENCE WORKS

Within the limits of the present discussion only a few of the more common types of reference works can be reviewed. In a search for highly specialized information the assistance of a trained librarian will often be necessary, but it is unfair to expect a library attendant to spend valuable time in doing what the student can and should do for himself. The reference works described below are such as any one should be able to use readily without assistance. Some of them are so constantly in demand that they should be included, if possible, in the investigator's private library.

The dictionary. A preliminary step in investigation of any unfamiliar subject is obviously the use of a good dictionary. Consulting an encyclopedia may or may not be the next step. Since most persons are confident of their ability to get all possible information out of the dictionary, any suggestions on the subject may be resented by the average reader as a gratuitous insult to his intelligence. Instead of suggestions or instructions, therefore, the following elementary problems in the use of the dictionary are submitted. The student who already knows all about the subject can do them rapidly. The slight effort required will be worth his while as a vindication of his own confidence. The one who encounters unforeseen difficulties and fails to make a perfect record will have more to gain, since he will learn something new in the process.

DICTIONARY TEST

Write as many answers as possible without consulting the dictionary. Then use the dictionary to correct mistakes and to supply omissions. Underscore the answers which you could not give correctly the first time.

1. Write the plural of "majority." Of "malady." Of "belfry." The singular of "apparatus."
2. Give five synonyms for "belief." From what source is the word derived?
3. What is the preferred accent for "contemplate"? By means of diacritical marks, indicate how the vowel sounds are pronounced. What picture, if any, is suggested by the original elements of the word?
4. Indicate the pronunciation, including accent, of c-o-n-t-e-n-t as a noun. As a verb. As an adjective. When would you use the noun in the singular, and when in the plural? Illustrate.
5. List and distinguish four synonyms for "demonstrate." Divide the word into syllables.
6. Give the derivation of "contend." What other words can you recall which have the same stem?
7. Explain the following idiomatic phrases containing "make": "make believe"; "make up (four meanings)"; "make head."
8. Explain the following abbreviations used in describing words: v. t.; n.; AS.; OF.; a.; Gr.; pl.; obs.; L.; v. i.
9. What is the meaning of the phrase *absit omen*? *allegro non tanto*?
10. Write the present participle, the past, and the perfect participle of "make." Of "belie." Of "contemn."

For this exercise, a recent edition of either Webster's *International* or the *Standard Dictionary* may be used. In either case, the collegiate or the large, unabridged, issue should be consulted.

Dictionaries of synonyms. Until the cross-word puzzle craze started, a good many people probably thought that Roget's *Thesaurus* was a monster from early geologic time, resembling the dinosaur. Nearly every one knows by this time that it is a very useful dictionary of synonyms, and many have come to regard as indispensable for desk reference either this book or some such parallel work as Crabb's *Synonyms*, Putnam's *Word Book*, Allen's *Synonyms and*

Antonyms, Fernald's *Synonyms, Antonyms, and Prepositions*, or an unabridged dictionary. Of course, the most important use for the dictionary of synonyms is as an aid to precision in the choice of words. A writer, let us say, wishes to describe a liquid that *tends to pass off rapidly in the form of vapor*. He can think of "evaporable," but that would mean only "capable of being evaporated" without suggesting rapidity or natural tendency. We have already seen (page 140) how conciseness in phrasing results from exactness in the choice of words. One word, "volatile," expresses all that is contained in the italicized passage above. Parallel examples can be supplied from the daily writing experience of every one. The regular use of a dictionary of synonyms in such cases or, at least, of the synonyms given in an unabridged dictionary, not only solves immediate problems of phrasing; it also makes important contributions to the student's working vocabulary.

The encyclopedia. Especially if the subject for investigation is a topic, rather than an individual word, an encyclopedia should be consulted. Of the two works which are most likely to be accessible—the *Encyclopædia Britannica* and *The New International Encyclopædia*—each has its special advantages. The articles in the *Britannica*, as a rule, are somewhat longer. They are often brief monographs on the subject. Those in the *International* are shorter and are restricted to more specific aspects of a topic. If, for example, we wish to learn something about "co-ordinates" or, more specifically, "Cartesian co-ordinates," the dictionary will help a little, but will only point the way by indicating briefly the meaning and the associations of the term. For a fuller discussion, we must go to the encyclopedias. Thanks to the dictionary, we shall not confuse the term with the Cartesian system of philosophy which we find under the heading "Cartesian." However, the term "co-ordinates"

in the geometric sense is discussed in the *International*. Although no entry for "co-ordinates" is given in the *Britannica*, we need only turn to the index volume to locate the discussion which occurs as a subdivision under the general heading "Geometry." Hardly any term can be so specific as not to be found in the *Britannica* index volume. On the other hand, comparatively few terms that we are likely to look up are not found in the consecutive alphabetical arrangement of the *New International Encyclopaedia*.

Biographical reference sources. Biographical information may be found in a variety of forms. Ideally, it is obtained through the reading of a complete life, such as Albert Bigelow Paine's life of Mark Twain or, in fact, any work of biography from Plutarch's *Lives* of the ancient Greeks and Romans down through Boswell's *Life of Johnson* to the latest works of contemporary writers such as Lytton Strachey or Gamaliel Bradford. Biography of this kind is as much in demand as fiction and is more interesting than most fiction. If time is lacking, however, or if the reader wishes to get specific facts rather than a fully developed account of the person's character, the *Dictionary of National Biography* is preferable. Essential information concerning Sir Isaac Newton or Michael Faraday, for example, may be obtained quickly from this source. If the names are those of Americans, a work like Appleton's "*Cyclopædia of Biography*" or the *Dictionary of American Biography* will be found convenient as a source of reference.

For data regarding contemporary British authors, artists, scientists, and others who have won distinction, the work to be consulted is *Who's Who*, an annual biographical dictionary published in London by Adam and Charles Black. Assume, for example, that you wish to look up Ramsay MacDonald's record or to determine where Rudyard Kipling was

born and when his principal works were written, or to discover George Bernard Shaw's place of residence and his favorite recreation. All such details will be found compactly summarized in *Who's Who*. Prominent Americans of to-day are similarly described in *Who's Who in America*. There are also a number of works listing people in professional groups, such as *Who's Who in Science* and *Who's Who in Engineering*.

Political and geographical reference helps. In the same way that one may choose between a long biography and a brief summary, one may learn of foreign countries either through descriptive travel literature or through such compact reference works as *The Statesman's Year Book*, a compendium of economic and political statistics. Suppose that upon short notice you are asked to find out something about Ecuador, Costa Rica, or some other foreign country. The following details are typical of the information obtainable in *The Statesman's Year Book*.

Ruler

Constitution and Government

Area and Population

(For statistics based on the 1930
census the 1931 edition should
be consulted.)

Religion

Instruction

Justice and Crime

Pauperism and Old-age Relief

Finance

Defense

Production and Industry

Commerce

Shipping and Navigation

Internal Communications

Money and Credit

Weights and Measures

Diplomatic Representatives

Bibliography

If a specific geographical fact is wanted, such a work as *Lippincott's Gazetteer* may be consulted. This work is more compendious than a postal guide, since it gives not only the location of a given city or village, but also its population and other facts about it. For example, twelve towns named "Hammond," ranging in population from 60 to 12,376, are given as being located in twelve different states of the United States. Every county also is located and described. The *Gazetteer*, moreover, is international in scope. One may expect to find in it an obscure country like the kingdom of Hedjaz, or an insignificant village like Lencloitre, a small town in France, sixteen miles north of Poitiers. For convenience of reference, all the geographical names used, whether they are American or foreign, and whether they denote cities, villages, counties, or nations, are given in strictly alphabetical order.

Dictionaries of quotations. In our reading we are constantly coming upon quotations and allusions, the significance of which we are expected to recognize. By presupposing our acquaintance with the original, the writer who uses the quotation pays a tribute to our assumed literary background. If we do not recognize the source, our natural impulse is to look it up. Purely as a matter of satisfying our curiosity, we wish to know what "Hobson's choice" means, or who said, "Peace hath her victories no less renowned than war," or to trace any other such expression to its source. A second reason for wishing to identify a quotation is that frequently its meaning is not clear without the context. Edward Bok, in his autobiography, *The Americanization of Edward Bok*, tells how as a boy he wrote to General Sherman asking for an autograph, and, at the same time, for an opinion on the saying, "The pen is mightier than the sword." General Sherman answered by advising

him to look up the context of a quotation before trying to interpret it, and called attention pointedly to the qualifying phrase in the original:

*"Beneath the rule of men entirely great,
The pen is mightier than the sword."*

Bulwer-Lytton, *Richelieu*, Act II, Sc. 2.

The author, the work, and the exact location of a phrase may be traced through the most important guide words, as "pen" and "sword," in the comprehensive alphabetical index of a reference work such as Bartlett's *Familiar Quotations* or Hoyt's *New Cyclopedia of Practical Quotations*.

The *World Almanac*. One kind of reference source remains to be mentioned,—the most miscellaneous of all,—and this brings us back to the library's consolation for any one who cannot become a walking encyclopedia. Current statistical information on virtually every subject can be found in a certain class of works of which *The World Almanac*, published annually by *The New York World-Telegram*, is probably the most conveniently accessible example. Every one is familiar with the sort of dispute which frequently arises in a company over such a question as, "In what year did 'Babe' Ruth make fifty-nine home runs?" Different versions are offered, and contradictions are exchanged with rapidity and perhaps with heat. Possibly a wager is laid. Of course, argument concerning a question of fact is futile, since the problem is not to talk an opponent down or to persuade him to change his attitude, but simply to find the answer. The questions given below will suggest something of the wide variety of information to be had from *The World Almanac*.

1. What is the national debt of the United States?
2. What are the three largest navies in the world?

3. Who is the champion swimmer of the United States?
4. List in the order of their railway mileage the three states of the United States having the greatest extent of railways.
5. What are the college colors of Cornell?
6. What was the score in last season's football game between Harvard and Yale?
7. What is the Hall of Fame?
8. Who is the present Secretary of the Navy?
9. What was last season's tobacco crop in the United States?
10. How does Detroit rank in size among the cities of the United States?

A department of the average daily newspaper which is certain to impress the uninitiated is the column devoted to general information on such matters as are covered by the foregoing questions. A glance at this column might suggest that it was conducted by the oldest and wisest man on the newspaper staff. As a matter of fact, it is probably the work of the youngest cub reporter, plus *The World Almanac* and a few similar books. Even so, the young man should be credited with wisdom of a very practical sort. He has made the fundamental distinction between things that he must know and things that he need only know where to get.

SPECIAL REFERENCE SOURCES

Besides the miscellaneous reference works and the other library aids which have been described, the student may use certain special helps which are often available. Typical of these are the comprehensive bibliographies issued by the Library of Congress on such subjects as "Aviation," "Ship Subsidies," "Boycotts and Injunctions," "Workmen's Compensation," "Trusts," and "Immigration."

Data for the study of recent and current questions may be found in very convenient form in the series of publica-

tions known as *The Reference Shelf*, issued by the H. W. Wilson Company. Each volume contains selected articles, briefs, bibliographies, debates, and study outlines. For debaters and for students of current history these helps are especially valuable. Among the topics covered by the series are the following:

- Cancellation of the Allied Debt
- Permanent Court of International Justice
- French Occupation of the Ruhr
(Debate between Oxford and Bates College)
- Restriction of Immigration
- Independence for the Philippines
- Power of Congress to Nullify Supreme Court Decisions
- Superpower
- Tax-Exempt Securities

Complete proceedings of university debates on such subjects as the foregoing are published in *The University Debater's Annual*, which is also issued by the H. W. Wilson Company.

Before he makes use of any special reference sources, the student will naturally consult the standard reference works. Then, if he wishes to make a more comprehensive investigation, he will add an increasing number of specific works. When he enters upon this second phase of his research, he will be surprised to learn how much of his task has already been done by members of the library staff. The farther he carries his investigation, the more he will appreciate his debt to those who have made the library a comprehensive system of classified knowledge.

CHAPTER XI

THE TECHNICAL WRITER'S LITERARY BACKGROUND

IN the discussion of style, it was pointed out that there is a narrow interpretation of technical writing which excludes everything suggestive of literary interest. According to this view, all technical writing is inevitably conventional and colorless, and the introduction of variety or individuality is a piece of impertinence. A person who writes an interesting, readable paper on a scientific subject is thus considered to be taking an unfair advantage of his more conservative fellow scientists.

How inadequate this notion of technical writing is, we have already seen. It has been shown that only a part of any one's written work is routine, and that even this part should have the distinctiveness which always results from first-hand observation and from clear thinking. It has been noted, also, that the written work for which every technical student must prepare includes a large number of letters, reports, papers, and articles which must be adapted to the non-technical reader's point of view. This kind of writing is really creative, notwithstanding its routine character, and is as superior to hack work as designing is to drafting. To the basic qualities of clearness and correctness, therefore, should be added a general effectiveness that will gain for the writer the support and the respect of educated men outside his own professional circle. Such effectiveness is the result, not simply of practice in writing, but even more,

of an adequate literary background. Good writing is thus a by-product of one's general reading.

The narrow view of technical writing is, in fact, a narrow and a decidedly uncomplimentary estimate of the writer himself. It assumes that the technical student's range, both of knowledge and of expression, will always be severely limited; that he will always talk shop and talk *shopppishly*. This means that in expressing his ideas he will be condemned to put on a sort of literary overalls—the plain livery of a workaday occupation. By inference, also, his contact with literature and the other fine arts is assumed to be negligible. He is denied the personal enjoyment of a rich cultural background and the fun of creative literary effort.

Although the "narrow" view is not unknown, it is fortunately becoming rare. Even where it influences educational policy, it is not explicitly stated or conspicuously advertised. It exists rather in the form of a tacit assumption that the technical student's training should all be of immediate practical value. The natural conclusion is, that the time in his college course should be spent exclusively on professional subjects, and that until a preliminary general course can be required for admission to technical colleges as it is already for schools of law and medicine, the technical graduate will be at a disadvantage in his cultural training as compared with members of the other learned professions.

Fortunately, the technical student is spared the necessity of accepting such a status. In the first place, the college which restricts him to utilitarian studies is the exception and not the rule. It is the old-fashioned, and not the modern, type of educational institution. Most colleges make some provision for cultural studies, and even those that do not require them usually encourage the choice of them as electives. In some technical schools an extended

program of collateral reading is required in connection with English or history, or both. What chiefly counts, regardless of the schedule of required or elective subjects, is the attitude of the individual student. If he is sufficiently interested in cultivating and perpetuating the habit of general reading, not even the most adverse attitude of his school can prevent him from gaining a background of literary knowledge. Just as he ultimately becomes his own critic in writing, he comes eventually to determine the quality and the quantity of his own reading. Classroom study may do much to widen his acquaintance with literature and to increase his appreciation of it. Supervised collateral reading will introduce him to a variety of works which educated persons are expected to know, and will give him an incentive to read and discuss books which might otherwise remain indefinitely on his waiting list. It is hoped that he will have the benefit of both these avenues of approach to literature, but with or without them, he can do some profitable things for himself.

Quite apart from the ultimate utility of a background of literary culture, the pleasure of acquiring it would alone justify the time spent in general reading. Especially is this true for the technical student, because the reading of literature introduces an element of the imaginative into a course consisting almost entirely of exact and literal subjects. It is genuinely recreational, since it provides a complete change of interests and therefore exercises a new set of "mental muscles." This fact goes far to answer the common objection that the technical student has no time for collateral reading. By judicious alternation of studies with recreation, which includes general reading, he may even gain efficiency in his technical work.

The technical student's need for literature is based on

the further fact that he is as human as anybody else. Because he is an educated person whose mind continues to function outside of working hours, he can appreciate literature as a form of art and as a criticism of life. In all fairness to him, this phase of his interests cannot be ignored. If his contact with humanistic studies is entirely neglected for the duration of his technical course, it will be resumed with difficulty, if at all, following his graduation. On the other hand, if the reading habit is encouraged and strengthened during his college course, his intellectual growth thereafter will be continuous and symmetrical, to the enhancement of both his personal enjoyment and his professional efficiency.

AN ENGINEER'S PRIVATE READING LIST

It is a well-known fact that the engineers who have gone farthest in their profession are men of broad training, self-acquired or otherwise. Their fondness for literature can easily be understood. The same daring imagination and the same sense of form which produce literature are needed for the really big feats of engineering. A typical example of a great engineer who was also a great reader was the late Benjamin G. Lamme, who for years before his death was Chief Engineer of the Westinghouse Electric Company. Mr. Lamme, himself a graduate of the Ohio State University Engineering School, kept his general reading abreast with his technical research throughout an exceptionally busy life. He will long be remembered for his active efforts to broaden the training of young engineers and for his generous bequest to aid technical students. An interesting sidelight on his personality is furnished by the list of his favorite weird,

imaginative stories, which he once prepared at the request of the late Charles Steinmetz. Although these books represent only one phase of his reading, they are suggestive of the wide range of his interests. This list, a copy of which was found among his papers, was published in the March, 1925, issue of the *Westinghouse Electric News*, with a foreword by Mr. B. Kupferberg. A part of the introduction and a representative selection of books from the list are quoted below:

Several years ago B. G. Lamme asked me to address the students of his Engineering School on the Inductive versus the Deductive Method in Science and Philosophy.

In the discussion that followed my talk, Lamme said, "We should always endeavor to deepen and expand our general knowledge even in fields where little or, perhaps, no empirical data have been inductively procured." In such cases, he emphasized, "It is by far better to accept, for the time being, the sentiments and speculative ideas arrived at intuitively, and not empirically, by great and honest thinkers, than to have no ideas at all."

The larger percentage of the books mentioned in his list deals with either prehistoric themes or subjects relating to the probable development of human life in the most remote future. Several of the authors had nothing else except the object of esthetics and pure beauty in their minds. They all deal with matters that lie entirely outside of the sphere of pure and accurate science.

To me this list reveals not only the marvelous reach and extent of B. G. Lamme's mental interests, but also, the sterling quality of his integrity as a teacher and mentor of educated young men. The list of his books shows that he never asked his students to undertake tasks that he himself would not try to perform. The books he read prove that B. G. Lamme sought for knowledge and information in provinces of thought that are far remote from exact science.

I am particularly impressed with his brief rating of the books: Fair, Good, and Very Good. It demonstrates his clear and excellent literary judgment.

AUTHOR	TITLE	TYPE OF STORY	RATING
H. G. Wells	Time Machine	Weird, imaginative	Very good
	Island of Dr. Moreau	Weird, imaginative	Very good
	Tales of Space and Time	Weird, imaginative	Very good
	When the Sleeper Wakes	A Story of the Future	Very good
	War of the Worlds	Weird, imaginative	Very good
	Thirty Strange Stories	Weird, imaginative	Very good
	First Man in the Moon	Weird, imaginative	Very good
	Food of the Gods	Weird, imaginative	Very good
	Twelve Stories and a Dream	Weird, imaginative	Very good
	The Invisible Man	Weird, imaginative	Very good
	The War in the Air	Weird, imaginative	Very good
	Men Like Gods	Weird, imaginative	Very good
Bram Stoker	The Country of the Blind	Short Stories	Very good
	Dracula	Vampire Story, weird, imaginative	Very good
	The Jewel of Seven Stars	Egyptian Story, weird, imaginative	Very good
E. L. Lester Arnold	Phra, the Phœnician	Re-incarnation Story, weird	Good
	Lepidus, the Centurion	Re-incarnation Story, weird	Very good
	The Aztec Treasure House	Adventure, imaginative	Fair
Thomas Janvier	In the Sargasso Sea	Adventure, imaginative	Good
	The White Company	Historical Adventure	Good
	Sir Nigel	Historical Adventure	Good
A. Conan Doyle	The Last Galley	Short Stories—Old Time	Good
	Strange Secrets	Weird Short Stories	Good
	The Lost World	Prehistoric life and imaginative	Good
Stanley Waterloo	The Story of Ab	Prehistoric Story	Very good
			Good

AUTHOR	TITLE	TYPE OF STORY	RATING
Gouverneur Morris	Pagan's Progress	Prehistoric	Fair
William Le Queux	Yellow Men and Gold	Adventure, imaginative	Good
	Eye of Istar	Adventure, imaginative	Very good
	Zoraida	Adventure, imaginative	Good
	Closed Book	Adventure, imaginative	Fair
Cutcliffe Hyne	The Lost Continent	A Story of old Atlantis	Good
W. Clark Russell	Frozen Pirate	Imaginative Sea Story	Very good
	The Flying Dutchman	Imaginative Sea Story	Fair
Théophile Gautier	One of Cleopatra's Nights	Short Stories, imaginative	Very good
Robert Chambers	The King in Yellow	Weird Tales	Good
	The Maker of Moons	Weird Tales	Good
	The Mystery of Choice	Weird Tales	Good
Lloyd Osborne	The Adventurer	Search for Lost City	Very good
Gustave Flaubert	Salammbô	Old Carthage	Very good
James De Mille	Strange Manuscript Found in a Copper Cylinder	Weird Story	Good
Frank R. Stockton	Vizier of the Two-Horned Alexander	Imaginative	Fair
	Great Stone of Sardinia	Imaginative	Fair
W. W. Jacobs	Lady of the Barge	Short Stories	Good
Mark Twain	Captain Stormfield's Visit to Heaven	Odd and funny	Good
O. A. Liljencrantz	Ward of King Canute	Historical	Fair
	Randvar the Songsmith	Historical	Fair
Jack London	Before Adam	Prehistoric	Good
	South Sea Tales	Odd	Fair
H. Rider Haggard	She	Imaginative	Good
	Ayesha	Imaginative	Good
	King Solomon's Mines	Imaginative	Good
	People of the Mist	Imaginative	Good

AUTHOR	TITLE	TYPE OF STORY	RATING
H. Rider Haggard	Montezuma's Daughter	Imaginative	Good
	Allen Quartermain	Imaginative	Good
	Marie—Zulu Stories	Semi-historical and imaginative	Good
	Child of Storm—Zulu Stories	Semi-historical and imaginative	Good
	Finished—Zulu Stories	Semi-historical and imaginative	Good
	When the World Shook	Imaginative, prehistoric	Good
	The World's Desire	Old Egyptian	Fair
	Smith and the Pharaohs	Short Stories	Good
	Treasure Island	Adventure (Classic)	Very good
R. L. Stevenson	Pacha of Many Tales	A Modern Arabian Night	Good
F. Marryat	Darkness and Dawn	Very weird, imaginative	Very good
G. A. England	Seeds of Enchantment	Weird Adventure	Good
Gilbert Frankau	People of the Ruins	A Story of the Future	Very good
William F. Shanks	The Moon Pool	Weird, imaginative	Very good
Abraham Merritt	The Clockwork Man	Weird	Good
E. V. Odle	The Girl in the Golden Atom	Weird, scientific	Very good
Ray Cummings			

SUGGESTIONS FOR COLLATERAL READING

Many influences determine the make-up of one's personal reading list, or, for the moment, his choice of a particular book. If he is following a definite course of study, covering a literary period or type, the list will be found ready prepared, with perhaps a subdivision into "required" and "recommended" works. The disciplinary value of such a definite program of reading done in connection with a formal study of literary history and criticism cannot be overestimated. In no other way can standards of appreciation be so quickly and so certainly acquired. Because of the universal recognition of this fact, it is assumed that every technical student who can possibly do so will elect one or more courses in literature.

Our present concern is with the more casual sort of reading which a student may do apart from any classroom study. Even though some of this informal contact with literature may include the completion of assignments in "collateral reading," it is understood that the student will exercise the largest possible degree of freedom in selecting the books within the list, and in reporting on them. In fact, their potency for the enrichment of his literary background depends almost wholly on the voluntary element in their selection. Perfunctory reading as a task, or stint, has little value. The student who is said to have spent twice the amount of time necessary on an assigned novel because his room-mate mischievously shifted the bookmark backward every few days, probably got very little out of the whole performance. To make the experience worth while, the reader should be interested or, better still, enthusiastic.

Of course, some books and some authors represent an acquired taste. A student may enter into an agreement

with himself to complete the reading of a work which people of undoubtedly good judgment have recommended, but which he finds uninteresting. Such an agreement may be needed in the case of some of those works which are commonly grouped together under the rather formidable name of "classics." If the student reads with an open mind, however, and with a sincere effort to discover *why* others have appreciated the book, he will assuredly gain something. If it happens that the work is unsuited to his mood or to the state of his experience at a particular time, it will wait until conditions are more favorable. Meanwhile, there is another book that is better suited to his present mood, and, with a little browsing, he will find it.

The suggestions given below are intended to encourage browsing. It is hoped that the student will be sufficiently interested in the titles to read a number of the works with which he does not happen to be familiar, or, for that matter, to renew acquaintance with some old favorites. The lists are intentionally left unclassified, and are as miscellaneous as the accident of alphabetical sequence can make them. The fiction group, it will be noted, is treated separately, but is arranged in straight alphabetical order according to the surnames of the authors. In sampling the authors and titles, and later the books themselves, the student will generally omit the short cuts to information that were emphasized in the chapter on "The Use of the Library." His motive this time is primarily recreational, and the knowledge which he will gain will be a by-product. In proportion as he reads for enjoyment he will profit directly by the mental relaxation and the gratification of his literary taste.

It should hardly be necessary to add that the lists are not meant to be exhaustive, if that were possible. They are merely suggestive compilations, made up very largely of books which technical students themselves have tried and

have recommended. Individual tastes vary so widely that even this fact, far from classifying the works, leaves them almost as miscellaneous as possible. There are, of course, some outstanding preferences for "men's books" and "men's writers." Kipling and Joseph Conrad, for instance, have a strong masculine appeal. At the same time, a diversity of interests and a variety of moods call for a decidedly mixed assortment of writers and works. The student may now sample the mixture if he will.

Abbott, Wilbur Cortez—*Conflicts with Oblivion*

Adams, Henry—*The Education of Henry Adams*

Adams, James Truslow—*The Epic of America; The Tempo of Modern Life*

Æschylus—*Prometheus Bound*

Aldington, Richard—*A Book of 'Characters.'*

Arnold, Matthew—*Culture and Anarchy*

Atlantic Classics

Bacon, Francis—*Essays*

Barrie, James—*Courage; The Admirable Crichton; What Every Woman Knows*

Barrus, Clara—*Life and Letters of John Burroughs*

Benét, Stephen Vincent—*John Brown's Body*

Benson, A. C.—*From a College Window; Ruskin*

Bergengren, R. W.—*The Perfect Gentleman*

Besier, Rudolph—*The Barretts of Wimpole Street*

Boccaccio, G.—*Decameron*

Bok, Edward—*The Americanization of Edward Bok; Twice Thirty*

Borrow, George—*Romany Rye*

Boswell, James—*Life of Johnson*

Bradford, Gamaliel—*Union Portraits; Confederate Portraits; Damaged Souls*

Broadus, Edmund Kemper—*The Story of English Literature*

Brooks, Charles S.—*Chimney-Pot Papers; Journeys to Bagdad*

Brown, Rollo Walter—*Lonely Americans; Dean Briggs*

Browning, Robert—*Pippa Passes; Rabbi Ben Ezra; Andrea Del Sarto*

Bryce, James—*The American Commonwealth*

270 ENGLISH APPLIED IN TECHNICAL WRITING

- Bunyan, John—*Pilgrim's Progress*
 Cabot, Richard C.—*What Men Live By*
 Carlyle, Thomas—*The French Revolution; Heroes and Hero Worship*
 Carnegie, Andrew—*Autobiography*
 Castiglione, Baldassare—*The Book of the Courtier* (Hoby's translation)
 Cellini, Benvenuto—*Autobiography*
 Cervantes, Miguel de—*Don Quixote*
 Chase, Stuart—*Men and Machines*
 Chaucer, Geoffrey—*The Canterbury Tales* (Tatlock & MacKaye, *The Modern Reader's Chaucer*, or Arthur Burrell, Everyman Edition)
 Chesterton, G. K.—*What's Wrong with the World?*
 Crothers, Samuel McChord—*The Gentle Reader; Among Friends*
 Curtis, George W.—*Prue and I*
 Dana, R. H.—*Two Years Before the Mast*
 Dante Alighieri—*Divine Comedy*
 Darwin, Charles—*Autobiography; The Voyage of the Beagle*
 Davies, W. H.—*Collected Poems*
 De Kruif, Paul—*The Microbe Hunters*
 Depew, Chauncey—*My Memories of Eighty Years*
 Dickinson, G. Lowes—*A Modern Symposium; The Greek View of Life*
 Drinkwater, John—*Abraham Lincoln; Oliver Cromwell*
 Drinkwater (J.), Canby (H. S.), and Benét (W. R.)—*Twentieth Century Poetry*
 Emerson, Ralph Waldo—*Essays, First Series; Essays, Second Series*
 Epictetus—*Moral Discourses*
 Everyman—*A Morality Play*
 Franklin, Benjamin—*Autobiography*
 Fritz, John—*Autobiography*
 Frost, Robert—*North of Boston*
 Galsworthy, John—*Strife; Loyalties*
 Gibbon, Edward—*Memoirs*
 Gibson, Wilfrid Wilson—*Poems*
 Goethe, J. W. von—*Faust* (Bayard Taylor's translation)
 Grant, U. S.—*Personal Memoirs*
 Gregory, Lady—*Seven Short Plays*

- Guedalla, Philip—*The Second Empire; Palmerston*
 Gummere, F. B.—(*Beowulf*) *The Oldest English Epic*
 Hackett, Francis—*Henry VIII*
 Hearn, Lafcadio—*Life and Letters* (Edited by Elizabeth Bisland)
 Henley, W. E.—*Collected Poems*
 Homer—*Iliad; Odyssey*
 How, Louis—*James B. Eads*
 Hubbell (J. B.), and Beaty (J. O.)—*An Introduction to Drama*
 Hudson, W. H.—*Far Away and Long Ago; Green Mansions; Idle Days in Patagonia*
 Husband, Joseph—*America at Work*
 Huxley, Thomas—*Lay Sermons*
 Ibsen, Henrik—*The Doll's House; The Master Builder; An Enemy of the People; Pillars of Society*
 Irving, Washington—*The Alhambra*
 Jeans, Sir James—*The Universe Around Us; The Stars in their Courses*
 Jerome, J. K.—*The Passing of the Third Floor Back*
 Jones, Henry Arthur—*The Liars; The Hypocrites*
 Jonson, Ben—*Every Man in his Humour; Epicoene, or The Silent Woman*
 Lamb, Charles—*Essays of Elia*
 Lamme, Benjamin Garver—*Autobiography*
 Lesage, A. R.—*The Adventures of Gil Blas*
 Leonard, Jonathan N.—*Loki, The Life of Charles Steinmetz*
 Leupp, Francis E.—*George Westinghouse, His Life and Achievements*
 Licks, H. E.—*Recreations in Mathematics*
 Lindsay, Vachel—*The Congo and Other Poems; Selected Poems*
 Lockhart, J. G.—*Life of Sir Walter Scott*
 Lomax, John—*Cowboy Songs*
 Ludwig, Emil—*Napoleon; Bismarck*
 McFee, William—*Casuals of the Sea*
 Macaulay, Thomas B.—*History of England; Essays; Lays of Ancient Rome*
 Machiavelli, N.—*The Prince*
 Maeterlinck, Maurice—*The Life of the Bee*
 Malory, Sir Thomas—*Le Morte d'Arthur*
 Masfield, John—*The Everlasting Mercy; Selected Poems*
 Masters, David—*The Romance of Excavation*

272 ENGLISH APPLIED IN TECHNICAL WRITING

Maugham, Somerset—*Our Betters; The Circle*

Maurois, André—*Ariel; Disraeli*

Millay, Edna St. Vincent—*A Few Figs from Thistles; Second April; The Harp-Weaver and Other Poems*

Milton, John—*Paradise Lost*

Molière, Jean B. P.—*The Shopkeeper Turned Gentleman; The School for Wives; The Miser; Tartuffe; The Physician in Spite of Himself*

Montaigne, M.—*Essays*

Morris, William—*The Earthly Paradise; Early Romances; The Life and Death of Jason*

Newman, John Henry—*The Idea of a University*

Newton, A. Edward—*The Amenities of Book-Collecting; Doctor Johnson—A Play*

Nibelungenlied (Lettsom's translation)

Noyes, Alfred—*Sherwood; Drake; Collected Poems*

O'Brien, Frederick—*White Shadows in the South Seas*

O'Neill, James—*The Emperor Jones; The Hairy Ape*

Page, Walter Hines—*Life and Letters*

Paine, Albert Bigelow—*Mark Twain, a Biography; Thomas Nast*

Palgrave, F. T.—*Golden Treasury*, both series

Parkman, Francis—*The Oregon Trail*

Pence, R. W.—*Short Stories by Present-Day Authors*

Pepys, Samuel—*Diary*

Percy, Thomas—*Reliques of Ancient English Poetry*

Pinero, Arthur W.—*The Second Mrs. Tanqueray; The Thunderbolt*

Plato—*The Republic* (Jowett's translation); *Dialogues and Discourses*

Plutarch—*Lives*

Poe, Edgar Allan—*Tales*

Pupin, Michael—*From Immigrant to Inventor*

Quiller-Couch, Arthur—*On the Art of Reading; On the Art of Writing*

Repplier, Agnes—*Americans and Others*

Rice, O. S.—*Travels and Adventures of Raphael Pumpelly*

Robinson, Edwin Arlington—*Tristram; Collected Poems*

Roe, Joseph W.—*English and American Tool Builders*

Rogers, R. E.—*The Voice of Science in Nineteenth-Century Literature*

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- Roosevelt, Theodore—*Letters to His Children; The Winning of the West*
- Rostand, Edmond—*Cyrano de Bergerac* (Brian Hooker's translation)
- Sandburg, Carl—*Abraham Lincoln, The Prairie Years*
- Schauffler, Robert Haven—*The Musical Amateur; The Poetry Cure*
- Service, Robert W.—*Rhymes of a Rolling Stone; The Spell of the Yukon*
- Shakespeare, W.—*Henry IV, Parts I and II; Henry V; Julius Cæsar; The Winter's Tale*
- Shaw, George Bernard—*Man and Superman; Candida; Cæsar and Cleopatra; Saint Joan*
- Sheridan, Richard Brinsley—*The Rivals; The School for Scandal*
- Slosson, E. E.—*Creative Chemistry*
- Slosson, E. E., and Downey, J.—*Plots and Personalities*
- Smiles, Samuel—*Lives of the Engineers*
- Smith, Charles Alphonso—*What Can Literature Do for Me?; Selected Stories from O. Henry*
- Sophocles—*Edipus Rex*
- Spenser, Edmund—*The Faerie Queene*
- Stock, Ralph—*The Cruise of the Dream Ship*
- Strachey, Lytton—*Eminent Victorians; Elizabeth and Essex; Life of Queen Victoria*
- Sullivan, Mark—*Our Times: the Turn of the Century*
- Teasdale, Sara—*Rivers to the Sea*
- Tennyson, Alfred—*Idylls of the King; In Memoriam*
- Thayer, W. R.—*Life of Cavour; Theodore Roosevelt*
- Thoreau, Henry D.—*Walden*
- Untermeyer, Louis—*The Book of Living Verse*
- Virgil—*Æneid*
- Walton, Izaak—*The Compleat Angler*
- Wells, H. G.—*Outline of History*
- White, William Allen—*Woodrow Wilson*
- Wilde, Oscar—*A Woman of No Importance; Lady Windermere's Fan; The Importance of Being Earnest*
- Woodruff, L. L. (editor)—*The Development of the Sciences*
- Wright, Frank Lloyd—*An Autobiography*

FICTION FOR THE GENERAL READER

Whether selected by an individual or a group, a list of fiction for general reading must be purely tentative. Except for a few classic examples, such as Palgrave's *Golden Treasury of Songs and Lyrics*, the Oxford books of verse, and the Eliot five-foot bookshelf, anthologies have not proved to be permanently satisfactory. Even so, it is good fun to make them, and perhaps better fun to criticize them. Since every one is free to make his own revisions, it is a game which all can play, and the original list may be useful chiefly as a point of departure.

If a definite number of works is adopted the list becomes more of a challenge, because each of its units is forced to compete with others which are almost equally eligible. Whether the arithmetical limit is stated in terms of the ten greatest philosophers, the fifteen decisive battles of the world, or the hundred best books, many are called which cannot be chosen, and there are certain to be some doubtful or border-line cases. The usual preference for one hundred as a basic number, though it might seem to be dictated by convenience of percentage computation, probably goes back to Sir John Lubbock's famous list of the "hundred best books." Since 1887, when his selection was first made public, Sir John has had so many critics and rivals that he may almost be said to have started a popular indoor sport. A radical variation from the usual form of anthology was proposed by Samuel McChord Crothers, who advocated publishing a list of the hundred worst books, on the theory that literary lighthouses should be erected to warn readers of the reefs and shoals which they should avoid. Of the recently selected "hundreds" for positive recommendation, the lists compiled for the American Magazine, by Will

Durant, and for the Golden Book by an advisory board, are doubtless familiar to most students.

The list of one hundred authors which are suggested below relates to fiction of the eighteenth, nineteenth, and twentieth centuries. Some of the titles which are placed second or third following the names of the authors would be given first choice by a number of readers. An inspection of the list may raise many questions of personal preference, with opportunities for the assertion of the reader's literary judgment. If the list seems to indicate variety and range rather than completeness or systematic grouping, sufficient reason may be offered in explanation. The term "general reading," of course, is elastic enough to cover a great diversity of interests, motives, prejudices and moods on the part of students who may care to choose some of the books for their own reading. It will be evident that the works cited here are not chosen or arranged for the sake of outlining a course in prose fiction. Books and authors chosen for systematic study should be taken up in a regular sequence indicating chronological or group relationship. Within certain limits of literary quality, those selected for general reading may be chosen at random. An attractive picture is that of the "omnivorous reader," whose range of choice shows that he is fiction-hungry and can enjoy a variety of literary food.

Of the motives which impel people to read fiction, perhaps the most common is the desire for escape. They read in order to leave the hum-drum activities of a fixed routine and to find refreshment in things strange and new. The more remote the setting is in time or space, the better. This craving for something different explains the unfailing popularity of romantic fiction. For the more discriminating reader, however, a mere change of scene will not suffice. The story must have the spirit of romance and it must ap-

peal to something essentially romantic within the reader himself. Such a reader is shown by Mr. Priestley in his description of the heroine in *The Good Companions*, a young woman who had a man's taste for fiction: ¹

Miss Trant went back to the Cottage and spent the next hour and a half with Redgauntlet, which she was reading for the fourth time. She had a passion for historical romances, not silly sentimental stories passing themselves off under cover of a few cloaks and daggers and "halidoms" or "Odds-fish," but real full-blooded historical tales. These she preferred to any other kind of fiction, and for the last twenty years they had been first her delight and then her solace. She loved to carry a secret message from Louis the Eleventh, of France, to Charles, Duke of Burgundy; to journey to Bloisin foul weather crying vengeance on the Guises; to peep out of a haystack at Ireton's troopers; to hide in the heather after Prince Charlie had taken ship to France; to go thundering over the Rhine with Napoleon and his marshals. To exchange passwords, to rally the Horse on the left, to clatter down the Great North Road, to hammer upon inn doors on nights of wind and sleet, these were the pleasures, strangely boyish, of her imagination. Few people who came upon Miss Trant sitting erectly with a book ever imagined for a moment that she was happily engaged in drinking confusion to the League or firing a matchlock. But such was her taste. Neither the laborious satire nor the luscious sentiment of our present fiction gave her any pleasure. She liked a tale to open at once, in the very first chapter, a little door through which she could escape and have bright sexless adventures. Novels about unmarried women who lived in the country, looking after aged parents or making do in genteel cottages, depressed her so much that she took pains to avoid them.

For such a reader some of the zest of romance may be carried over into the actualities of everyday life. If not, the story may compensate for the absence of actual adventure.

In the reading of realistic, as distinguished from romantic, fiction, the pleasure to be found is commonly said to be that of recognition. Coming upon a description of familiar

¹ Priestley, J. B.—*The Good Companions*, Harper and Brothers. Used by permission.

scenes or situations in a "slice-of-life" novel, the reader exclaims "How true! It is just as if one were looking at an actual clothesline in an actual village backyard." But most persons do not find their chief pleasure in acknowledging the accuracy of a mere photographic image. The recognition which the average reader enjoys most is that which is accompanied by the discovery of some unexpected significance or interest in commonplace and familiar things. For this reason good realism is closer to romance than may at first be supposed. Among twentieth-century novelists few have exhibited a more solid, literal and complete realism than that which characterized the work of the late Arnold Bennett. He was not merely a recording instrument, however, but an interpreter, and his transcripts from life were made with a romantic gusto which the reader involuntarily shares.

Of course, as H. G. Wells points out, the hero of a story may have as exciting adventures among new ideas as among strange people, and so may a reader of fiction. Or, to revert to the interpretative phase of the realistic novel, the reader may discover new significance and even matter for philosophy beneath the surface of the familiar world about him. In Wells's *Tono Bungay*, for example, it is the ideas that are the most rewarding, even though the story is entertaining enough to be read as pastime fiction.

Considering form for a moment, as distinguished from content, the reader may find his greatest pleasure in the sheer artistry of a story. Conrad's *Youth*, Galsworthy's *Indian Summer of a Forsyte*, and Willa Cather's *Death Comes for the Archbishop*, are examples of works which are superbly well done. They delight the reader with their perfect fitness of language to the subtle requirements of character and situation. Even an unpleasant theme may be made acceptable by artistic treatment. On the other hand,

the novelist who offends by crude technique as well as "raw" material adds insult to injury. Fortunately, the general reader, to whom no works are assigned as a task, is privileged to let such an author severely alone.

Something of the foregoing kinds of pleasure will always be found in the best fiction. An indispensable attribute that may be assumed for all good stories, regardless of setting or ideas, is the creation of life-like, interesting people and the just interpretation of their characters. Whether their essential traits are dramatized, as by George Meredith and John Galsworthy, or analyzed, as by Henry James and May Sinclair, one learns the qualities and motives behind their acts and comes to know the fictitious persons better than living acquaintances. In thus getting at the inward qualities of hypothetical people, one discovers much about the general truths of psychology and behavior. A good story, even though it be read only for entertainment, will leave the reader with some added knowledge of the inexhaustible complexities of human nature.

FICTION, EARLY AND RECENT

1. Aldrich, Thomas Bailey—*Marjorie Daw and Other People*
2. Andreyev, Leonid N.—*The Red Laugh; The Seven that Were Hanged*
3. Austen, Jane—*Pride and Prejudice; Emma*
4. Balzac, Honoré de—*Pere Goriot; Eugenie Grandet*
5. Beck, L. Adams—*The Ninth Vibration; The Way of Stars*
(Also as E. Barrington—*The Divine Lady; The Chaste Diana*)
6. Bennett, Arnold—*The Old Wives' Tale; Clayhanger; Denry the Audacious*
7. Beresford, J. D.—*The History of Jacob Stahl*
8. Boyd, James—*Marching On; Drums*
9. Brontë, Charlotte—*Jane Eyre*
10. Brooks, Charles S.—*Luca Sarto*

11. Buchan, John—*Greenmantle*; *John Macnab*; *The Three Hostages*
12. Bunner, H. C.—*Short Sixes*
13. Butler, Samuel—*The Way of All Flesh*
14. Byrne, Don—*Hangman's House*; *Messer Marco Polo*
15. Cabell, James Branch—*Jurgen*; *The Cream of the Jest*
16. Cable, George W.—*Old Creole Days*
17. Cather, Willa S.—*Death Comes for the Archbishop*; *My Antonia*
18. Chekov, Anton—*The Darling and Other Stories*
19. Chesterton, G. K.—*The Man Who Was Thursday*; *The Innocence of Father Brown*
20. Clemens, Samuel—*The Adventures of Huckleberry Finn*; *The Adventures of Tom Sawyer*
21. Collins, Wilkie—*The Moonstone*; *The Woman in White*
22. Conrad, Joseph—*The Nigger of the Narcissus*; *Lord Jim*; *Youth*; *A Set of Six*; *Typhoon*; *Nostromo*
23. Daudet, Alphonse—*Letters from My Mill*; *Tartarin of Tarascon*
24. Defoe, Daniel—*Captain Singleton*; *Moll Flanders*
25. De Morgan, William—*Joseph Vance*; *Alice-for-Short*
26. Dickens, Charles—*David Copperfield*; *Our Mutual Friend*
27. Dostoevsky, Feodor—*Crime and Punishment*; *The Brothers Karamazov*
28. Douglas, Norman—*South Wind*
29. Doyle, A. Conan—*Adventures of Sherlock Holmes*; *The White Company*
30. Dreiser, Theodore—*An American Tragedy*; *Sister Carrie*
31. Dumas, Alexandre—*The Three Musketeers*; *The Black Tulip*
32. Eliot, George—*Adam Bede*; *Middlemarch*
33. Farnol, Jeffrey—*The Broad Highway*; *The Amateur Gentleman*
34. Fielding, Henry—*The History of Tom Jones*
35. Fisher, Dorothy Canfield—*The Bent Twig*
36. Flaubert, Gustave—*Madame Bovary*
37. Forster, E. M.—*A Passage to India*
38. France, Anatole—*The Crime of Sylvestre Bonnard*; *Thaïs*
39. Galsworthy, John—*The Forsyte Saga*; *A Modern Comedy*; *The Patrician*
40. Garland, Hamlin—*Main-Travelled Roads*; *A Son of the Middle Border*
41. Glasgow, Ellen—*The Romantic Comedians*; *Barren Ground*
42. Goldsmith, Oliver—*The Vicar of Wakefield*

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43. Hardy, Thomas—*Tess of the D'Urbervilles; The Return of the Native; The Mayor of Casterbridge*
44. Harte, Bret—*The Luck of Roaring Camp and Other Stories*
45. Hawthorne, Nathaniel—*The Scarlet Letter; Mosses from an old Manse*
46. Hergesheimer, Joseph—*Cytherea; The Bright Shawl*
47. Hewlett, Maurice—*Richard Yea and Nay; The Queen's Quair*
48. Howells, William Dean—*The Rise of Silas Lapham*
49. Hugo, Victor—*Les Miserables; The Hunchback of Notre Dame*
50. Jacobs, W. W.—*Many Cargoes; Salthaven*
51. James, Henry—*The American; The Ambassadors; The Turn of the Screw*
52. Kaye-Smith, Sheila—*Joanna Godden; The End of the House of Alard*
53. Kingsley, Charles—*Westward Ho; Hypatia*
54. Kipling, Rudyard—*Kim; The Day's Work*
55. Lewis, Sinclair—*Babbitt; Main Street; Arrowsmith*
56. Lincoln, Joseph—*Cape Cod Folks; Blowing Clear*
57. Locke, W. J.—*The Beloved Vagabond; Septimus*
58. London, Jack—*The Call of the Wild; Smoke Bellew*
59. Lytton, Edward Bulwer—*The Last Days of Pompeii*
60. Marshall, Archibald—*The Eldest Son*
61. Maugham, Somerset—*Of Human Bondage; The Trembling of a Leaf*
62. Maupassant, Guy de—*The Odd Number*
63. Maurois, André—*The Silence of Colonel Bramble*
64. Meredith, George—*The Egoist; The Ordeal of Richard Feverel*
65. Merejkowski, Dmitri—*The Romance of Leonardo da Vinci*
66. Mitchell, S. Weir—*Hugh Wynne, Free Quaker*
67. Morley, Christopher—*Parnassus on Wheels; The Haunted Bookshop*
68. Morrison, Arthur—*Tales of Mean Streets*
69. Parrish, Anne—*The Perennial Bachelor*
70. Poe, Edgar A.—*Tales*
71. Porter, Sidney (O. Henry)—*The Four Million; Cabbages and Kings; Strictly Business*
72. Priestley, J. B.—*The Good Companions; Angel Pavement*
73. Reade, Charles—*The Cloister and the Hearth*
74. Richardson, Samuel—*Pamela*
75. Rolland, Romain—*Jean Christophe*

76. Scott, Sir Walter—*Old Mortality*; *Quentin Durward*
77. Sidgwick, Ethel—*Hatchways*
78. Sinclair, May—*The Divine Fire*; *A Cure of Souls*
79. Steele, Wilbur Daniel—*Land's End*
80. Stephens, James—*The Crock of Gold*
81. Sterne, Laurence—*Tristram Shandy*
82. Stevenson, R. L.—*The Master of Ballantrae*; *Kidnapped*
83. Stockton, Frank R.—*A Chosen Few*
84. Swinnerton, Frank—*Nocturne*; *Young Felix*
85. Tarkington, Booth—*Alice Adams*; *The Magnificent Ambersons*;
Claire Ambler
86. Thackeray, W. M.—*Vanity Fair*; *The History of Pendennis*
87. Tolstoi, Count Leo N.—*Anna Karénina*; *War and Peace*
88. Tomlinson, H. M.—*Gallions' Reach*; *All Our Yesterdays*
89. Trollope, Anthony—*Barchester Towers*
90. Turgenyev, Ivan—*Fathers and Sons*; *Smoke*
91. Unset, Sigrid—*Kristin Lavransdatter*
92. Walpole, Hugh—*Fortitude*; *Jeremy at Crale*
93. Wassermann, Jacob—*The World's Illusion*; *The Maurizius Case*
94. Watts, Mary S.—*The Rise of Jennie Cushing*; *Nathan Burke*
95. Wells, H. G.—*Tono Bungay*; *Kipps*; *Ann Veronica*
96. Wharton, Edith—*Ethan Frome*; *The House of Mirth*; *The Age of Innocence*; *Xingu and Other Stories*
97. Wilder, Thornton—*The Bridge of San Luis Rey*
98. Woolf, Mrs. Virginia—*Mrs. Dalloway*; *To the Lighthouse*
99. Wylie, Elinor—*The Venetian Glass Nephew*
100. Young, Francis Brett—*Sea Horses*; *Mr. and Mrs. Pennington*

CHAPTER XII

SUGGESTED EXERCISES

THE student is invited to use the following exercises as a means of testing and strengthening his grasp of various principles which have been discussed in the preceding pages. Many of the questions call for outside work, to be completed and brought to class like assigned problems in mathematics. Some of the exercises are sufficiently brief and simple to be used as impromptu tests. In either case, the student is expected to work out his own answers and to verify their correctness so far as possible without the instructor's aid. The class discussion may thus be abbreviated, since it will be concerned mainly with a checking of the student's conclusions. It is expected that the study of this book will be accompanied by the use of exercises and illustrations gathered from the work of each particular class, and that members of the class will refer constantly to problems of expression in their everyday manuscripts. In this way each student may learn to improve the writing which he is regularly called upon to do.

1. **Accuracy test.** As a test of your observation, copy page 19, taking care to reproduce the spelling, punctuation, underscoring, indentation and all other mechanical details exactly as they appear in the original. If you type the manuscript, make your copy exactly like the example, even to the division of words and the differentiation between double and single space. If your copy is handwritten, do not try to vary the vertical spacing of lines, but place

the text on the page so as to reproduce all margins, headings, and other details in the proportions of the original and in accordance with the rules on pages 15 to 17. If your manuscript is one hundred per cent correct the first time, it will be marked "OK," and you will have done with the exercise. Otherwise, it will be returned, to be rewritten entire. It will continue to be returned as long as you continue to make one mistake or more in accuracy.

2. **Page Layout.** Supply a title to the following passage and arrange the text so as to show the logical relationship between the various units of the text. Give careful attention to the indenting of paragraphs, and to the placing of main headings, sub-headings, and tabular statements. Follow the directions in the text with regard to the capitalization and punctuation of headings.

After a manufacturing company has been organized, several problems must be solved before construction of the factory is begun. These preliminary considerations, which are partly economic and partly engineering or industrial, determine very largely whether the factory is to be successful. Economic factors. The geographical situation of a manufacturing plant depends upon the following factors: (a) Location of raw materials (b) Location of market (c) Cost of transporting raw materials (d) Cost of transporting finished goods (e) Location and housing of labor supply. The significance of the foregoing items varies with the nature of the product to be manufactured. In the fabrication of structural steel, for example, the most important factor is freight. In the manufacture of such products as clocks and cutlery, on the other hand, freight costs are of minor importance as compared with labor supply. Engineering factors. After the geographical location of a factory has been determined by means of an economic survey, the actual site is next selected with reference to certain engineering considerations. These include topography, conditions of sub-soil, convenience to railways, and connections with water, gas, power, and sewer lines.

3. **Test in observation and critical reading.** The foregoing exercises have purposely emphasized the observation of purely mechanical details. As a means of testing his accuracy of observation, the student can well afford to concentrate for a time upon such matters as the capitalizing or underscoring of a word, the placing of an exponent, or the indenting of a heading. This drill in sheer copying, however, is only preliminary to a kind of "close reading" which is far more important: namely, the reading which seeks to get the exact meaning of a passage and to learn the reasons behind the use of a particular mechanical form. Study, whether of English or of any other subject, calls for accurate observation

plus an alert attitude in which the student is constantly questioning, and perhaps challenging, the statements which he reads. The analytical approach, as represented by such an attitude, will doubtless mean slower progress at first. In the long run, however, it will mean a saving of time through efficient methods of study. It will also mean greater clearness in the student's expression of his own ideas.

After you have studied the sections of Chapter II which deal with punctuation and spelling, write the answers to the following questions concerning the extract, "Surface Hardening of Steel by Nitriding" (page 19).

1. Why is the hyphen used in "case-hardening"?
2. Explain the use of the comma after "process." (line 3)
3. Should the second half of the quotes around "nitriding" (line 4) be placed inside or outside the comma? What is the rule?
4. Why is a comma used after "advantages"?
5. Explain the use of the hyphen in the expression "metal-to-metal contact."
6. Account for the comma following "In general."
7. Is the spelling "aluminium" correct? Is it preferable? Explain.
8. Discuss the spelling and the origin of "per cent."
9. Comment on the forms "sulphur" and "sulfur."
10. Explain the use of the comma after the words "suitable for nitriding."

Anticipating a later discussion of grammar, logic, and other aspects of sentence structure, answer these questions regarding the form of statement used in various parts of the same selection.

- a. In division (c), does the second use of "to" aid in making the meaning clear? Explain.
- b. What is the important word in the phrase "a popular one"? Can you condense the phrasing here and at the same time improve the emphasis? How?
- c. To which word does "it" refer, "combination" or "process"? Explain.
- d. If "this combination of results" is a subordinate idea, used to explain the main statement, how can you re-phrase the sentence to give greater prominence to the main subject? Would the sentence pattern, "Owing to this combination," etc., improve the emphasis? Complete the rephrasing. Suppose the pattern were changed to "The popularity of the nitriding process" or "Notwithstanding the comparative recency of its adoption," etc., would either of these forms be desirable? Why? Test the proposed sentences for connection with the preceding passage as well as for clearness and emphasis.
- e. In the second section, do you prefer the wording, "that not all steels can be nitrided" to "that all steels cannot be nitrided"? State clearly the reason for your choice between these forms.

4. **Close reading of the text.** The following questions presuppose a close (preferably oral) reading of the first four pages of Chapter II, that is, of pages 10 to 14, inclusive. Similar questions may be asked concerning any other passage of text that is accessible to the class as a whole. Extracts made from a book on chemistry or mathematics are especially desirable as a basis for a test in close reading.

1. Page 10, first paragraph.

(a) At what point near the middle of the first sentence do you pause slightly in order to make the meaning clear?

(b) What two expressions in the second half of the first sentence are made to stand out most conspicuously?

(c) What is the relationship between the two main divisions, or clauses, of the first sentence? Can you express this relationship by changing the pattern of the sentence and substituting "but" for "though"? Could you use "notwithstanding" in a version which would express essentially the thought of the sentence as it stands? Write two sentences one of which uses "but" and the other "notwithstanding."

(d) Does the division of the word "favorable" at the end of line 8 agree with your usual syllabication? How is the division of a word determined?

2. Page 10, second paragraph.

(a) The first sentence contains two parallel clauses, each containing the words "will not." To what expression in the preceding paragraph does each of these clauses refer?

(b) What shade of meaning or emphasis is conveyed to you by the word "mere" in the phrase "mere externals"? Why is the phrase enclosed in quotation marks?

3. Page 11, first paragraph.

(a) The phrase "without conscious effort" is in logical contrast with two expressions found earlier in the paragraph. What are they?

(b) How do you pronounce the word "progress," used as a noun? How would you divide it? Enunciate clearly the word "automatically." How many syllables does it contain?

4. Page 11, second and third paragraphs.

(a) Find a logically parallel, equivalent, or balancing expression for each of the following:

"repeated" and

"copying" and the

"rules" and

"with confidence" and

(b) Should any of these parallel words be omitted, or does each add a shade of meaning that should be kept? Explain, in each case.

5. Page 15, first paragraph.

(a) How do you pronounce "leading" in line 8? What does the word mean, as it is used in this connection? Explain fully.

(b) As between the two forms "indentions" and "indentations," which seems preferable? In connection with your answer, cite the reference works which you have consulted.

5. Abbreviations and numerals. Rewrite the following sentences, using numerals and abbreviations correctly. Be prepared to defend your action either in changing an expression or in allowing it to stand. Assume that every sentence is taken from connected discourse in average technical writing.

a. These results were obtained with the feeders operating at twenty-five revolutions per minute and delivering five hundred pounds of powdered coal per feeder per hr.

b. The coal was pulverized until eighty-five % of it passed through a one hundred mesh screen.

c. In figure 2 is shown a detailed comparison of two sizes of stokers, numbers three and four, showing their respective capacities and dimensions and space occupied, etc.

d. The boiler designated as number eight was one of 8 standard Edgemoor water-tube boilers, designed for a working pressure of three hundred lbs. per sq. in.

e. At the bottom of the 4th pass samples of flue gases were taken from the 3 pipes (Figure 7) leading to the dust-collector. The economizer samp. were taken with single open-end samp. tubes, the intakes of which were at the cent. of the streams.

6. Problems in punctuation for clearness. If a reader were left to do his own punctuating he might spend a great deal of time wavering between alternative interpretations. As an exercise, this form of deliberation has something to recommend it; otherwise, the problems which follow might well be omitted. But we study punctuation in order to apply its rules from the writer's point of view. If a student says in an examination paper, *Wordsworth's poorest poems are The Idiot Boy and Goody Blake and Harry Gill*, the absence of quotation marks leaves a reasonable doubt as to the number of poems he meant to designate. He probably knew his facts, and we may give him the benefit of the doubt; but he has no right to ask any concessions. His responsibility, and his exclusively, is to use every punctuation mark needed to express his exact meaning.

Assuming that you are the writer of the following sentences, punctuate them so that the intended meaning, as you conceive it, shall be made immediately and unmistakably clear. If your punc-

tuation calls for differences in the capitalizing of certain words, you may revise the spelling accordingly. Do not make any changes in the phrasing.

1. As the grinding speed increases the abrasive surface wears down proportionately.

2. Owing to the use made of gravity pumps are not needed to distribute the water to the various levels.

3. A charge of powder has potential energy a flying bullet has kinetic energy.

4. Men are not what they think they are but what they think they are.

5. Mr. Shaw says Mr. Archer has abundant wisdom but is not taken seriously by the general public.

6. Scholasticism asked what is the thing and lost itself in quiddities Darwinism asked what is its origin and lost itself in nebulas Pragmatism asks what are its consequences and turns the face of thought to action and the future.

7. The editor placed special emphasis on what he termed the quiet style in technical writing. He said an important requirement in engineering articles is simplicity of diction. Use plain Anglo-Saxon words instead of long Latin ones. Say do rather than accomplish and try rather than endeavor. A common fault is the use of bulky expressions such as for the performance of the milling operation this machine is used. The writer could just as well say for milling instead of using the long expression.

8. Although chemists no longer hold that there is a great gulf fixed between organic and inorganic chemistry and although certain organic compounds can now be made artificially in the laboratory every living thing performs many complicated chemical processes which the chemist can neither duplicate nor understand. In particular the power which all kinds of protoplasm have of converting food substance into their own particular kinds of protoplasm the power of assimilation is a chemical secret which the mind of man has not yet been able to discover although every cell of his body knows this secret.

9. According to the author membership in what he calls The Fifth Estate should be reserved for the men of science who have as he puts it the simplicity to wonder the ability to question the power to generalize and the capacity to apply.

10. In a treatise entitled The Four Kinds of Economic Value the author uses the term value in four different senses as follows use value which represents the immediate utility of the goods to the consumer esteem value which represents the demand created by scarcity workmanship or other considerations apart from utility cost value which represents the outlay for labor and material involved in the production and marketing of the goods and exchange value which represents the readiness with which the goods may be sold or converted into other commodities.

7. The comma with transposed expressions. One of the most troublesome questions of punctuation is that of setting off transposed expressions. Such expressions constantly occur, for several very good reasons.

Although the normal order of words in a sentence demands that adverbial modifiers follow the predicate, other considerations frequently require them to be placed before the subject. Emphasis may call for a periodic arrangement, as in the sentence which precedes this one. Close connection may require a linking adverbial expression, such as "In this manner," or "Notwithstanding these objections." Expressions of time, in particular, are placed at the beginning of the sentence, in order to fix the point of view for the main statement and to avoid ambiguous or mistaken reference of the time elements themselves. Such familiar textbook sentences as, "We visited the place where the Battle of Bull Run was fought yesterday afternoon," are needed in the exercise lists because some writers are careless about transposing their time modifiers.

The general rule covering all the foregoing cases is that transposed adverbial elements should be set off by commas. In much well-written and well-edited matter of the present, however, this rule seems to be disregarded. Particularly with shorter elements the comma is usually omitted where the meaning is clear without punctuation and where a long pause for emphasis is not desirable. In the sentence, "Fifty years ago such a feat would have been considered miraculous," the comma is not needed after the time modifier. Incidentally, it may be noted that the "phrase pause" at "ago" tends to set off the time element and to create a sort of "vocal punctuation" which insures recognition of the opening phrase as a distinct unit. This sentence is one of many examples in which the arrangement of words lessens the need for punctuation. In such cases even the marked pause for emphasis may safely be left to the reader's discretion. On the other hand, there are many sentences in which the comma must set off the adverbial element in order to avoid word combinations that misrepresent the writer's meaning. The following sentence is a case in point: "As the population increases the demand for improved transportation facilities grows in proportion." The sentence is not very well written, but assuming that it shall stand without revision, a comma is evidently needed after "increases." A number of sentences containing transposed adverbial elements are given below. The student is asked to note the point at which the comma is needed to make the meaning immediately clear. Of course the reader's inflection must always aid the punctuation in interpreting the meaning. Sometimes, as in the two possible phrases containing "at"

in example (h), oral punctuation alone may decide the position of the phrase pause.

- a. From the bunker tubes lead into the boiler.
- b. At least you could have told him.
- c. In the laboratory tests are made of all raw materials before they are purchased.
- d. When the piston moves back the cylinder is filled with vapor.
- e. Before the invention of the motor people were compelled to do a great deal of work by hand.
- f. For making chemical solutions absolutely pure water is needed.
- g. As a nation advances the men of science become more important to its welfare.
- h. The detective had many narrow escapes. He was shot at once by a whole gang of criminals.

8. Spelling—completion of word forms. Fill in the letters necessary to complete the words which are partially spelled out below. Do not feel obligated to supply exactly the number of letters represented by the open spaces, but use your own judgment to determine when a word is complete and correct. Deduct two points from one hundred for each space that is wrongly filled in.

We enclose a spec_m_n of bu_ness stat_nry re_mended by our com_tee. We do not wish to emb_r_s you or to interfere with your ind_p_n_d_nce in selecting your own supplies, but we h_lve that you will gain def_n_te advantages by using this or a s_m_l_r form. Your pr_f_rnce will of_c_rse be determined by local req_rments, but judging from your d_scrip_n of conditions, we feel that the sample will meet your needs. Under sep__te cover we are mailing a par_ll series of forms for interdepartmental cor_sp_nd_nce. You will note the rep_t_n of the princ_p_l identifying details, with occas_n_ly a dif__nt arran_mnt or a change in size of type. We shall be glad to rec_v_e f_rther inquir_s from you and shall consider it a priv_lge to give you the ben_f_t of our exper_nce.

9. Words frequently misspelled. At the instructor's dictation, write the list of words found on page 40. Check your exercise for possible errors, and deduct one point for each misspelled word to find your grade on a scale of one hundred per cent. If a re-checking of your list should show that you have overlooked any misspelled words, a further deduction of two points for each word should be made. The checking process is really a test in accuracy of observation.

10. Spelling—a supplementary list. As you study the follow-

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ing group of words commonly misspelled, make a list of those which have been spelled incorrectly in your own manuscripts. In addition to reviewing the individual words, analyze your list and classify the words according to typical difficulties, e.g., "able" and "ible" words. Try to find rules that will help.

abbreviation	comparative	having	permissible
absence	compiled	illustrate	phenomenon
absorption	consistent	independent	practicable
accessories	convenient	inexhaustible	preferred
accompanying	development	ingenious	preliminary
acetylene	device	irresistible	preparation
aisle	devise	installation	prove
annually	diameter	itself	recognize
apparatus	differential	kerosene	repetition
approximate	divide	knowledge	replacement
arrangement	eighth	manual	resistance
available	eliminate	masonry	safety
balance	employee	maximum	separate
beginning	English	metallurgy	shown
beneficial	equipment	miniature	similar
boundary	equivalent	nickel	specimen
brake (break)	existence	ninety	supersede
bulletin	explanation	noticeable	symmetrical
buoyant	extension	nozzle	together
buses	finally	occurred	unmistakable
caisson	financial	omission	tuyere
cancellation	forty	paid	vice versa
changing	fourteen	particle	
chemistry	fulfill	penetrate	
classification	fundamental	perform	
coefficient	generator	permanent	

11. The writing of compound words. Make any changes which you think are needed in the spelling of the following compound words and give your reason in each case.

a. Since the type writer has a single alphabet key board a shift-key must be used. To raise and lower this key is a time consuming operation for the beginner.

b. The over head charges shall be interpreted to include liability insurance, though this item may be added to the pay roll and may thus be made a direct-charge against labor.

c. With the Parsons unit, there are six sets of three stage steam-jets and four hydraulic vacuum pumps; and with the Westinghouse units, there is one Le Blanc air-pump.

d. The power-unit consists of a four cylinder Ricardo engine, which develops

80 horse power. The crank shaft is of high grade steel, heat treated and ground after treatment.

e. The cost of transportation by motor-trucks is here given in terms of ton miles.

12. Critical Reading—Supplementary Exercises. A passage of text assigned for study may be scanned hastily, or it may be read closely and carefully. Every one knows that close reading is necessary for an understanding of the subject matter. Nothing less than concentration upon the text deserves to be called "study." It is not so generally realized that a wide-awake, questioning, challenging study of the text is equally profitable as training in composition. Especially if the passage is read aloud, the student acquires a feeling for the pattern of a sentence and for the logical balance and agreement which grammatical forms are meant to express. It is suggested that supplementary exercises in oral reading be drawn from the texts which the student happens to be using at the time when he is studying this book. Works on mathematics, physics, chemistry, and economics are suited to this purpose. The ideal situation is one in which two persons studying together take turns in reading the text aloud to one another. Reports on such reading should include quoted sentences or passages which have occasioned uncertainty concerning the author's meaning.

a. Taking your illustrations from this book or any other text, quote three passages which you found to require particularly careful reading. Try to decide whether the difficulty should be charged to the complexity of the idea or to the obscurity of the language.

13. Logical sequence and subordination. On the general principle that an outline of a manufacturing process begins with the raw material and then follows through to the finished product, rearrange the topical headings and subheadings below into a "contents" type of outline. (For arrangement, see page 18.)

THE MANUFACTURE OF VALVES

Assembling the valve units. Machining the valve parts. Cleaning the castings. Analyzing the raw materials in the laboratory. Mechanical cleaning. Pouring the metal. Collecting the raw materials. Cleaning by hand. Water-pressure tests. Melting the metal. Iron. Bronze. Nickel. Testing the valves. Oil-burning furnaces. Making the molds. Electric furnaces. Air-pressure tests.

14. The construction of an outline. After reading, or hearing read, a selection,—for example, George Herbert Palmer's *Self-Cultivation in English*, put down what seem to you to be the principal main topics and sub-topics of the author's outline. In phrasing your headings, make them as definite and self-contained as possible. Especially avoid general or conventional headings, such as "Introduction" or "Conclusion." Use the "table-of-contents" form for the arrangement of your headings and sub-headings.

15. Analysis and classification. An outline may be offered as an answer to an assignment in making outlines, or it may be used as a means of expressing the results of a careful analysis. Merely by glancing at it, one may know whether it has been hastily or lazily assembled. The thoughtfully developed outline will show an important basis, completeness, and logical sequence and subordination of units. Here are two "lazy" outlines which any one could scribble down at a moment's notice. The subjects, "Unemployment Insurance," and "Television," are worthy of much better classifications, which you are asked to supply. Criticize these outlines, analyze the subjects, and then submit the results of your particular analysis.

(a) Unemployment Insurance	(b) Television
The idea of unemployment insurance	Development of television
Causes	In Europe
Results	In America
Comments	Present stage of television
Unemployment insurance at present	Sending
Trials	Receiving
Results	Future of television
Comments	
The outlook for unemployment insurance	
Attitude of employers	
Attitude of employees	
Conclusions	

(c) Criticize the following main divisions of an outline on "Causes of Automobile Accidents." Is the basis clear? Is it

sound? Can you supply a better one? Are the divisions all of the same rank? Is there any overlapping between them? Can you think of any specific causes which are not included in these four divisions? Test this last point by filling in a complete list of sub-headings under each of the four main heads.

CAUSES OF AUTOMOBILE ACCIDENTS

Human failures

Mechanical failures

Dangerous highway conditions

Unfavorable weather conditions

16. **Sentence unity and completeness.** Convert each of the numbered passages below into a clearly unified sentence. *Do not merely join the separate parts, but rephrase and rearrange the material to form a single clear, complete, logical, and close-knit statement.* Suppose, for example, that the italicized sentence which you have just read were given in fragmentary form. It might read somewhat as follows:

Do not depend entirely on connectives. Join closely the ideas expressed in the separate parts. Make the sentence clear and logical. Rephrasing may be necessary. Do not hesitate to make any new arrangement that seems to be needed. The main objective in your revision is to get a close-knit sentence.

Although this collection of short and broken units is more than twice as long as the italicized sentence, it does not express the thought so clearly. Smoothness, unity, and clearness are all improved by the use of a complex sentence form to express complex relationships between ideas.

1. The semi-colon differs from the comma. In a sense, it is a magnified comma. It is used to separate longer units of text. Sometimes the units are comparatively distinct from one another. This may be true in a series. It is often true in a compound sentence where no connective is used to join the clauses.
2. On the regulation of fuel consumption, whether it is carefully managed, depends to a large extent the success of a modern power plant, competition being what it is in industry to-day.
3. The most interesting part about this process is that a catalytic agent is used to bring about the hydrogenating action. Whereas without the nickel used as a catalyst you would not be able to complete the needed reaction. Thereby making impossible an important chemical process.
4. Do not confuse waxing with polishing. Such treatment really fills the pores of the wood and insures a smooth floor surface.
5. The process of converting a vegetable oil into a solid is called "hydrogenation" and was discovered in the latter part of the nineteenth century. Marking a great advance in industrial chemistry.
6. The table brings out two facts very clearly. The area of flame contact must be increased in order to improve the thermal efficiency. Each added unit of flame contact area produces a smaller increase in the efficiency of heat utilization.
7. All these toys are incombustible and are superior to celluloid. A child may get near a flame with a celluloid doll or rattle. Such a burn is not only painful but serious consequences may ensue.
8. Your order of March 9 has been received. We thank you very much for it. We are sending the goods by express as you requested. They should reach you within three days from this date.
9. Filtration is generally considered to be purification by straining or passage through a porous medium, which medium allows the liquids or gases to pass through but retains the solids, and the power necessary for this action being produced by differences of pressure on the two sides of the filter medium.
10. The size of the pores in the filter medium has an upper limit, the largest number of pores of such size is of course desirable, but this is a technical matter and simply means a choice among comparatively few materials.

17. **Experiments with sentence patterns.** If a writer has a complex idea to express, he may not arrive at a satisfactory form of statement until he has experimented with several versions. The writer of the following sentence, for example, tried several forms before he arrived at this one:

"To maintain a hydrogen ion concentration that is best for each process is obviously impossible, since the optimum for enzyme production is 3.4, the optimum for sucrase activity is 4.5, and the optimum for zymase activity is 7.0."

As compared with versions beginning, "The difference of optimums," "The impossibility of maintaining," "The best hydrogen ion concentration," "Owing to differences," and a near satisfactory one beginning "It is obviously impossible," the sentence quoted is the best. The latter part may be a trifle bulky, but the sentence as a whole reads smoothly. Moreover, its form indicates that the writer was thinking directly and clearly when he wrote it. In other words, the *logical pattern* of his thought dictated the grammatical form in which that thought was expressed. Even a reader who is wholly unfamiliar with the subject matter may recognize the clearness of the sentence form.

Following the method indicated below, submit two or three versions of a sentence with which you have experimented in your own writing. Also, choose the particular sentence in (1) and (2) which you believe comes nearest to a satisfactory expression of the writer's meaning. Give reasons for your selection. Answer the questions, and suggest any changes which you would recommend as refinements of the preferred sentence.

1. The writer of the report containing the following sentence wished to recommend that paper be stored and printed under identical conditions of temperature and humidity in order to prevent expansion or shrinkage, since even a slight change would cause faulty register in successive printings. At the time of his investigation the paper was stored in a dry, warm room on the fifth floor and was brought down one roll at a time to be printed on the first, or basement floor of the plant, in a press room that was relatively cool and moist. Which of the following three sentences comes nearest to making a clear statement of the reason for his recommendation? Why? Point out the violations of clearness which you find in each sentence.

- a. The storage of the paper on the first floor as recommended causes it to be stored and printed under the same conditions of temperature and humidity, resulting in more uniform quality of printing.
- b. If the paper is both stored and printed under the same conditions of temperature and humidity, proper register can be obtained. The storage of the paper stock on the first floor will insure uniform conditions for printing.
- c. By storing the paper stock on the first floor, where it is printed, conditions of temperature and humidity will be kept uniform, and consequently a better job of printing can be secured.

2. Compare the following sentences, on the basis of clearness and completeness. Which is the better? Why? Point out specifically the faults of the

poorer sentence. If possible, revise the better sentence for clearness and smoothness.

- a. In one type of bank indicator a steel ball is free to roll back and forth in an arc-shaped closed glass tube, its motion being retarded or "damped" by a suitable liquid.
 - b. One type of bank indicator shows the degree of departure from a correct banking angle by means of a steel ball within a closed glass tube which is arc-shaped. The ball rolls in response to certain changes of angle, its motion being retarded or "damped" by a suitable liquid.
3. Submit several versions of a sentence over which you have labored. Draw your examples from a piece of writing which you have recently done. Perhaps the formulating of a definition or the writing of a conclusion for a report will yield the best examples of difficult sentences.

18. Specific mistakes in sentence form. The following brief sentences, which illustrate a variety of common mistakes, have been contributed unwittingly by the writers of numerous actual statements. Although some representative specimens are traceable to class assignments, not all the examples are taken from college manuscripts. The student should have little trouble in discovering and perhaps labeling the chief fault in each sentence. The important thing, of course, is that he should know how to correct the sentences. A review of Chapter IV and a forward look into the discussion of "Persistent Errors" will aid in the identification and correction of mistakes.

1. The load is applied to the specimen to be tested by means of screws.
2. These screens keep floating objects which might damage the machinery out.
3. The mixture is allowed to stand, and after hardening, the catalyst is filtered out.
4. Please send any reports submitted to you to us in order that we may place them on file.
5. These castings would be difficult to handle in a shop where they have no cranes.
6. Minor ailments and teeth of the factory employees are regularly looked after by the health department.
7. Each pump pumps thirteen hundred gallons of water at a stroke.
8. The disadvantages were noted and a new press designed to handle the work.
9. An engine will not burn fuel unless it has been vaporized.
10. The furnace is lined with brick, each brick costing one dollar.
11. Before describing the process of paper making a brief description of the power plant will be given.
12. The engine was started, but it did not run smoothly, so a set-screw was loosened, but this did not help matters.

13. Any noticeable negligence, if reported to the management, will be appreciated.
14. One of the principal considerations in power plant practice is control location with reference to power distribution.
15. In the boiler room are fourteen boilers. These are of the Babcock and Wilcox type and constitute the power equipment.
16. One chemical theory assumes the decomposition of the silver and that the bromide is given off.
17. Because of this arrangement no current flows through the relays but merely circulates through the transformer windings.
18. Instead of cutting the corrugated board used for protecting the frame with a knife the packer uses a saw.
19. This blade is manufactured on the newest and highest type of machinery built for the purpose from the finest Swedish steel.
20. The cruising range of the new ship is 2,000 miles more than the Graf Zeppelin.
21. When a drop of oil is added to water it acts like a living thing.
22. The finished product is canned, sealed, and wrapped by machinery.
23. The air waves strike the metal disk causing vibration.
24. A few advantages of this machine are the following: automatic oiling; a cam feed replaces the old ratchet feed; internal transmission.
25. Purification of brine before evaporation by the Skinner and Baughman method is both feasible and economical.
26. A water softener removes the lime from the water before it is fed into the boilers thereby preventing boiler scale.
27. As for the contractor knowing whether prices will rise or fall, do you?
28. The first operation consists of tearing the fibres apart, this is done in the beaters.
29. This automobile has a fifty-horsepower motor that is free from vibration and is equipped with hydraulic brakes.
30. An electrically operated crane is used to raise and lower the screen and the heavy gates are also controlled by an electric switch.
31. Water gradually was added until the substance was completely gotten into solution.
32. An important feature of this factory, in which a total of 6,000 persons are employed, is the testing department.
33. The pulp is boiled in rotary horizontal cylinders in milk of lime, a suspension of calcium hydroxide in water for twelve hours.
34. The pilot feels no discomfort when moving in a straight line only the turns bother him.
35. The inventor does not contend that his machine will take the place of the present equipment, but rather will serve to increase its efficiency.
36. Hose nozzles at the rim of the reservoir are used for washing the sides and bottom of the reservoir.
37. The meter registers the weight of the water which goes through it in pounds.
38. The cost and tendency of the glass to crack under temperature changes make it undesirable.
39. At the present time the cost of transportation is so great that the high

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price paid for many commodities is due almost entirely to the high cost of transporting them.

40. Better results are obtained with wood than with steel and concrete ties.

41. On the top of the base are four small stands which support the lever which in turn supports the table on which the weight is applied.

42. Very few mineral waters contain no salts of calcium and magnesium.

43. All the current passing through the armature also passes through the field which creates a large counter electromotive force.

44. The oil is sent to the recovery plant, cleaned and returned for use as before.

45. The bar was clamped between the jaws of the testing machine and the machine started.

46. The readings are taken with a microscope so arranged that work mounted on a stage controlled by micrometer screws registers positions with respect to the cross hairs of the microscope.

47. In this type of stoker the ram pushes the coal, which falls down before it by gravity, into the furnace.

48. The two valves, although perfect in other respects, were rejected because of slight defects in the surface of the castings. This shows the high standard maintained by the company.

49. It is evident, is it not, that we can, if we like, substitute for any of these variables, what?

50. This unit is known as the "retort" and consists of a cylinder, a ram and a crank, to actuate the ram.

19. Review problems in sentence writing. The following exercises are designed to supplement the usual drill in the details of sentence construction. The examples are actual sentences taken from a variety of contexts. It is hoped that the accompanying suggestions concerning the background and purpose of each sentence will sufficiently indicate the needed revision. The problem of phrasing the sentence clearly is for the student to work out.

Instead of exemplifying isolated faults or principles, most of the sentences illustrate a number of difficulties in combination. In the more important kinds of composition the writer's task is not to make a simple choice between a correct form and a wrong one. Beyond a certain point the question is not so much one of grammatical correctness as of general effectiveness. Instead of two possible forms, there are many; and, according to the skill and thought represented, they may range from undesirable or impossible, through satisfactory and preferable, and thence to excellent. As Robert Louis Stevenson says in his essay on *Style*, the writer is like a conjurer who must keep several oranges in the air at one time. He must give attention simultaneously to various aspects of thought

and form, for, as Stevenson goes on to say, a sentence is both a logical pattern and a pattern of sounds in time.

After studying the suggestions, revise the sentences below to express the intended meaning. If necessary, change the logical and grammatical pattern completely. Try to make your sentence clear, smooth, compact, and precise.

a. Due to the embrittling of steel, it is only in recent years that the hardening property of nitrides has been taken advantage of.

Apart from the undesirable "due to" and the awkward "taken advantage of," the sentence contains some violations of logical clearness and consistency. Some background facts from which the writer was trying to derive a statement are these: early attempts to use nitrides for hardening steel resulted unsatisfactorily, because the steel was embrittled by the hardening process; the embrittling tendency has lately been overcome; nitrides are now used successfully as a means of hardening steel.

b. Old methods of hand firing still remained, however, until a realization of the importance of the economies possible in the utilization of fuel resulted in the development of mechanical methods of firing.

The phrasing is bulky; note the number of phrases introduced by "of." The language is abstract; note the words ending in "ion," "ment" or "ance." A worse fault, however, is the misleading emphasis at the beginning. We are led to expect a contrast between old methods of hand firing and new methods of hand firing. Instead, the intended contrast is between hand firing and mechanical firing and the purpose of the sentence is to explain why one superseded the other.

c. Molded or pressed glass is what is used in cheap common spectacles and should be avoided as it is injurious to the eyes, therefore impairing the vision.

The purpose of the foregoing sentence is quite evidently to warn the reader against the purchase of spectacles made from cheap glass. Through an "illegitimate and" construction, the first clause is made parallel with the main clause, "should be avoided." The idea, "used in cheap common spectacles" is an incidental thought. It belongs to the subject of the main assertion, but only as a subordinate part. The idea, "injurious to the eyes," is repeated unnecessarily in "therefore impairing the vision." The adjectives "cheap" and "common" are evidently meant to be co-ordinate and nearly synonymous. A comma should be placed between them.

d. Buying and selling futures in the stock market is no more unethical than a person who makes a contract for the future delivery of some manufactured article, which is not classed as gambling.

The writer, who is discussing the ethics of speculation, holds the view that all agreements for future purchase or sale are essentially alike. The principle, he believes, is precisely the same whether the agreement has to do with goods to be manufactured or with securities. Inasmuch as a contract for the future delivery of goods which have not yet been produced is considered entirely ethical, he feels that an agreement for the future delivery of stock which has not yet been acquired should be similarly approved by public opinion. Revise the sentence to express his idea clearly, smoothly and concisely.

e. The usefulness of conveyors in this plant is shown by the fact that the belt brings the condensers which have been previously assembled at the far end of a long table to aligners whose task is to take off and adjust the condensers.

The repetition of "condensers" is sufficiently obvious; so is the bulkiness and awkwardness of "the fact that." The logic of the sentence is faulty, since the usefulness of conveyors throughout the plant is not established by reference to a particular and relatively minor example. The latter part of the sentence contains some unnecessary material which tends to shift the emphasis to the incidental idea, duties of the aligners. Return the emphasis to the conveying operation. Of course a belt conveyor is the type which the writer of the sentence has in mind.

f. The normal voltages of house lighting lines for different cities vary from 110 to 125, depending upon the particular city.

Note the ambiguity of the foregoing statement. Does the voltage within a particular city fluctuate all the way from 110 to 125? Or is the voltage established at a single figure for each city? Does the variation occur, then, as between cities? Assuming that each city has a fixed voltage, revise the sentence to make clear this idea.

g. The force applied causes the object to act against the frictional resistance of the surface and the mass of the object to do work and stretch the spring.

In this explanation of how a force is measured, the problem is to state what effect is caused by the application of the force and to explain how this effect is measured. Supply the omitted ideas and condense the bulky, roundabout expressions.

h. Only as you learn through many seasons and with what tireless persistence this car continues to perform in the brilliant manner that inspired your first delight is its true value revealed.

This sentence was actually used in a piece of advertising copy. Note the lack of grammatical balance between "through many seasons" and "with what tireless persistence." The pattern of the sentence is unfor-

fortunate in that the main thought is kept dark to the end. This is not a legitimate periodic form but a "suspended construction." The point of view is shifted as between "you learn," second person, active, and "is revealed," third person, passive. Look closely for other faults, then try a brand-new sentence pattern to express the writer's probable meaning.

i. Leonardo da Vinci, often referred to as the first engineer, as presented by Merejowski, is a man whose breadth of vision would be called large, even in this day when the seemingly impossible is being accomplished on every hand.

Two parenthetical expressions in succession at the beginning of the sentence create an ambiguous as well as an awkward construction. Note the "centrifugal" tendency of "when the seemingly impossible," etc. Try to improve the massing of the sentence in such a way as to keep all the essential ideas.

j. The surplus from the sale of capital assets should be kept separate from the earned surplus, for the profits realized from this source may be due to an appreciation of their value on account of rising prices generally.

The probable meaning of this sentence may be studied out, but not easily. The expression "this source" is ambiguous at first reading. Its reference is later explained by "their value," which must refer to the plural base "assets" rather than to the singular term "surplus." The phrasing is so bulky and involved that the sentence may be regarded as a puzzle. Yet the writer's intention is merely to state a distinction between two concepts and to show why the differentiation should be made. It is a case, like many others, in which the supposed difficulty of the subject matter is traceable to obscurity in the phrasing.

INSTRUCTIONS AND SPECIFICATIONS

The writing of instructions and specifications is generally recognized as a large and a very important part of the engineer's work. What is not so commonly appreciated is that such writing is fundamentally a problem of constructing clear sentences. The technical phases of specifications may be taken for granted. It may be assumed that the writer has a sufficient knowledge of underlying principles and is in a position to check the details for completeness. The really difficult task is to phrase the successive statements with absolute clarity. A letter of instruction which must be explained and interpreted in further correspondence is too ex-

pensive a luxury to be tolerated in any well-managed business organization. The practical, financial value of good English is best appreciated by firms and individuals that have suffered from costly mistakes or still more costly litigation caused by some one's imperfectly written specifications.

In every case, the writer's problem is to bring about what lawyers call "a meeting of minds." There is a legal side, or at least a potentially legal aspect, to such writing that calls for the adoption of the lawyer's point of view. As laymen or rank outsiders, we may be amused at what seems to us the excessively formal or technical language of legal documents. We may join in the ridicule of legal tautology with Sir Richard Steele, whose play, *The Funeral*, contains such choice examples as, "I, the said Earl of Brumpton, do hereby give, devise, bequeath, convey," et cetera. At the same time, we must recognize the importance of precise, explicit language in documents that must ultimately stand the test of the courts. Since there is always the possibility that correspondence and specifications may be subjected to this test, it behooves the writer to take a leaf from the lawyer's notebook. Let him form the habit of making his statements clear enough to be used in a contract or a patent claim. Then he need have no fears about writing specifications.

20. Directions and explanations. Study the following passages to discover the intended meaning; then rephrase the sentences so as to express the ideas with unmistakable clearness.

a. Indicate by the letter L in column 5 each permanent employee who has more than one year of service, who is more than 25 years of age, who earns more than \$175 unless he has been less than 12 years in school, has been absent sick more than two days or has a service rating of less than 80 or more than 90.

The foregoing quotation from a set of directions was meant to indicate clearly which employees were to be included in the list marked with the

letter "L" and which were to be excluded. Your re-phrasing should leave no doubt regarding the two groups.

b. The load derived from W and the spring balance reading multiplied by the perpendicular distance of its line of action from the axis of revolution measures the reaction T, against which the armature is turned.

Is the load (L) derived from the quantity $(W + S)$, assuming S as the spring balance reading? Or does one take the load that has been derived from W and add it to the spring balance reading, then multiply the sum $(L + S)$ by the perpendicular distance? After you have decided upon the answers to these and other questions, write a version that shall make your interpretation clear and consistent. Perhaps a little reading on the subject of dynamometers will give you a better technical background for understanding the context, but the passage should be regarded as primarily a problem in phrasing. A clear statement, even of the wrong idea, should entitle you to credit.

c. Section 200 on page 21 of Tariff 30-E "Import Rates from Pacific Coast Points" states that the preferential rate of \$4.00 per hundred pounds is allowed on:

"Furniture, bamboo or wooden, knocked down or nested, boxed, wrapped or crated; Chairs, Settees and Tables with Bamboo and Reed Frames, wrapped with braided or twisted sea grass or wrapped with rattan, reed or cane fibre, knocked down, flat, boxed, crated or wrapped."

The shipper has crated part of the bamboo chairs in their set up form and has boxed the others flat after knocking them apart. He wishes a ruling on whether all the chairs must be knocked down *and* packed flat in order to be sent by the preferential rate, or whether the conditions for this rate would be satisfied if the chairs were knocked down, *or* nested, *or* boxed, *or* crated, *or* wrapped. In other words, has the shipper five optional ways of packing the chairs? The railroad company contends that only a combination of knocking down and boxing flat can secure the preferential rate. Read the tariff statement carefully and determine whether its language compels the one kind of packing which the railroad company wishes. If it does not, how would you re-phrase the passage to make the railroad company's intention definitely clear? (This case was the subject of a prolonged controversy.)

d. The following actual letter from one plant executive to another is awkwardly phrased and is somewhat obscure. After noting the suggestions, write a substitute letter to set forth the purchaser's ideas compactly and in language that is reasonably smooth and precise.

ATTENTION J. W. DUNHAM

GENTLEMEN:

It was our understanding with your Mr. Mason that it would not be necessary to ship the motor referred to in your letter of March 25 for mount-

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ing on the hog jaw puller we have on order. We were instructed to send you a motor dimension print so that you could make the required provision for mounting in our plant following shipment of the puller. Apparently you are expecting us to ship the motor to your plant for mounting, so we would like to have you advise us promptly if the dimension print is not sufficient for you to work from and if it will be necessary for us to ship the motor both ways.

The writer had ordered the puller only, because his firm wished to use a motor that was already on hand.

He sent the seller a motor dimension diagram in order to show just how and where the motor would be mounted after the puller arrived.

The seller's representative, Mr. Dunham, wished to have the actual motor sent to be mounted on the puller and shipped back with the puller when the latter was delivered.

The writer still feels that shipment of the motor is unnecessary and seeks to persuade Mr. Dunham to use the motor dimension diagram instead of the motor itself.

Note the ambiguous use of "if" in the last sentence of the letter.

21. Sentences from specifications. The following "first draft" sentences need revision for smoothness, conciseness, and clearness. Study carefully the suggestions given below and write answers to the questions; then rephrase each sentence in such a way as to make it express unmistakably the intended meaning.

1. On passenger service, where there are two or more elevators in the same hatchway, an 8-inch beam should be placed, by the owner, between the elevators at each floor to support the guide.

(a) The comma following "service" is misleading. Why?

(b) Would the phrase "passenger elevators" aid in condensing the expression?

(c) The phrase "by the owner" is awkwardly wedged in between "placed" and "between the elevators." Transpose it, or express the same idea differently.

2. The term elevator car refers to the suspension sling (commonly called the cage) the platform and the cab or the wainscoting around the platform in the case of a freight elevator.

(a) Show clearly that the suspension sling and the platform are common to both kinds, and that the elevators differ in the type of cab which covers the platform.

(b) Take out the parenthesis marks and add any punctuation needed for clearness.

3. Single-phase alternating current such as is used for lighting, is only suitable for the operation of very light elevators and the polyphase current is preferred for this purpose.

(a) "Only" is misplaced. Explain, and give the rule.

(b) Re-phrase to emphasize the idea that polyphase current is preferable, even for very light elevators, and that the use of single-phase alternating current, though possible, is undesirable.

4. An instantaneous pressure on any button will send the car to the corresponding floor, providing all the doors are closed, and the elevator is not in use.

(a) "Instantaneous" is meant to describe the response of the elevator to pressure on any one of the buttons. Does it do this?

(b) A latent idea is, that there is a button for each floor. Does "corresponding" express this idea? Can you put the idea more explicitly?

(c) "Providing." Should "provided" be used instead of "providing"?

(d) In general, can you bring out more clearly the idea that the elevator will respond instantly only under certain conditions, and can you make clear just what those conditions are?

5. VARIABLE VOLTAGE CONTROL: Has its greatest application where the source of current supply is alternating and where the speed of the elevator is high.

(a) As a heading, "Variable Voltage Control" has no grammatical connection with the sentence which follows. Make the phrase a part of the sentence and change the punctuation and capitalization accordingly.

(b) How should you punctuate the phrase to make it mean "Control of variable voltage"?

(c) In your revision, use the expression "alternating current" to avoid the suggestion that the "source" alternates.

6. Mild steel is used to a considerable extent and has a breaking strength about 50 per cent greater than the iron cable.

(a) This sentence contains an "illegitimate and" construction. Explain.

(b) Does the main statement have to do with the breaking strength of mild steel, or with the extent of its use?

(c) Assuming that mild steel is used because of its greater breaking strength, rewrite to make this idea explicit and to put the main and subordinate units of the sentence in their proper relationship to one another.

7. The strength of the six-strand cable is not greatly different from the eight-strand cable, although the wires in the eight-strand cable are smaller.

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(a) The comparison following "is not greatly different" is logically incomplete. What is missing?

(b) Why is "although" the wrong word? What word or phrase should be used in order to bring out the logical relationship between two clauses?

(c) Rewrite the sentence beginning with "The six-strand cable" and using those words as the subject.

8. The retarding force required to stop a descending elevator car traveling at a speed of 600 feet per minute, in a distance of 2 feet, is nearly double the weight of the car and the load, while the force required to stop the car traveling at a speed of 300 feet per minute, in one foot, is nearly fifty per cent more than the combined weight of the car and the load.

(a) "In a distance of 2 feet" refers, of course, to "stop." Would "within" be better than "in"? Can you recast the sentence in such a way as to place this phrase immediately after "stop"?

(b) The use of "while" in this sentence is not good. Why? What is a better way of expressing the relationship clumsily indicated by "while"?

(c) "In one foot" calls for the same corrections as "In a distance of 2 feet."

(d) Could the ideas in sentence No. 8 be expressed better in two or three sentences? Why? Test the point by writing it in several different ways.

9. There are four types of rope drives in common use on elevators. The V groove drive, consisting of a driving sheave scored with grooves, having the shape of a V, which grips the cable and thus provides sufficient traction to prevent slipping, has the widest application.

(a) Why should "drives" be changed to the singular form in this sentence?

(b) Would "which consists" be better than "consisting"? Why?

(c) The comma between "grooves" and "having" misleads the reader, since "having" is restrictive and is not meant to be parallel with "consisting." What is the function and the construction of "having"?

(d) In the passage, "which grips the cable," to what does "which" refer? How can you make this reference more definite?

(e) Note the long separation of the subject, "The V groove drive" from its predicate, "has the widest application." Can you bring these expressions closer together?

10. The V groove elevator is perfectly reliable and will give excellent service, providing the proper number, size, and type of cables are used, providing the driving sheave is the proper diameter and properly grooved and providing the cables have sufficient arc of contact on the driving sheave and the car and counterweight are sufficiently heavy.

(a) The "and" relationship at the beginning of this sentence, although not indicated by perfect logical and grammatical balance, is much better than the one in No. 6. Why?

(b) Change "providing" to "provided" and then re-phrase to eliminate the repetition of this purely introductory expression. Should the phrase be "provided that"? Can you make one use of it suffice? If so, how can you establish parallel structure between the units which express the series of requirements?

22. The writing of explanations and instructions. In the manner of the example quoted below write a brief description of a piece of equipment, together with an explanation of its use. You might deal with a subject such as the stock room in a factory or the card catalogue in the college library. Your explanation should give the reader sufficient information to enable him to use the equipment or system described.

A FILING SYSTEM FOR CORRESPONDENCE

Large steel cabinets are used to enclose our filed correspondence. These cabinets or files are of a size that will allow a letter, without being folded, to be placed with the longer side parallel to the bottom of the file drawer.

The files are indexed alphabetically by large gray tabs. The main or primary indexes are black letters on white background and are all to the extreme left of the file drawer. The subordinate or secondary indexes are black letters with gray background. In order to give a clear vision of the file, these secondary tabs are graduated to the right under each primary letter.

(A sketch may be used advantageously here.)

The "two-name" system is used. The first name determines the primary letter under which the correspondence is to be filed and the second name indicates the secondary letter. The correspondence is filed alphabetically; that is, "American Can Company" correspondence is filed under primary "A," secondary "C." Similarly "Crosley Radio Corporation" would be filed under primary "C" and secondary "R."

One general file is maintained for all departments. Inter-office correspondence is filed within the general file and under the office writing the letter; that is, immediately behind the primary index "D" is a folder marked "Detroit," and all correspondence originating at the Detroit Office is filed in this folder. A number of special folders of this type are maintained for special customers with whom a considerable volume of correspondence is carried on. This procedure eliminates the necessity of leafing through all the documents in the general file in order to get at the correspondence of a particular customer.

23. Studies in paragraph unity. A piece of writing may be difficult to read because of either excessive or inadequate paragraph division. To be sure, the units of text should be of reason-

able length, and the sentences composing them should be grouped according to principles of unity and logical sequence. The following passages illustrate both insufficient and excessive paragraphing, or perhaps a mixture of the two. After examining their content carefully, suggest the re-grouping of sentences which you believe to be needed for unity and clearness.

A

A visit to a soap factory leaves the average observer somewhat bewildered. He seems to have learned a great number of strange new terms and to have gained a variety of more or less vague impressions. On taking stock of his information, however, he finds that the manufacture has seemed far more complex than it really is. The large-scale production, the quantity and diversity of raw materials, and the variety of by-products have temporarily caused him to forget that the manufacture of soap is really a fairly simple process. Of the raw materials used in soap making the most important, of course, are the fat stocks. Other essential materials are alkali and salt. All ordinary animal and vegetable fats are a compound of glycerin and a fatty acid. When an alkali like caustic soda is intimately mixed with a fat of this kind, a reaction takes place by which the fat is split into its two components. The sodium in the caustic soda then attaches itself to the fatty acid of the fat to form the soap. The glycerin is thus liberated and is dissolved in the water that may be present. This process, called "saponification," is the primary reaction in the soap making process. The soap "kettles," in which the saponification takes place, are hardly kettles at all; they are simply cylindrical tanks about as high as a two-storey house with a conical bottom. They will hold 300,000 pounds of water and are usually stocked with 200,000 pounds of oil. One hardly realizes what an immense quantity of oil this is. Suppose that the average beef yields 200 pounds of rendered tallow, a liberal estimate. Then the tallow from 1000 beeves would be necessary to stock one kettle. To stock the 125 kettles in one large factory would require the slaughter of 125,000 head of cattle. These kettles are all stocked at least once each month, but of course other fats in addition to tallow are used for the purpose.

B

Fundamentally, radio broadcasting accomplishes what is done with the modern telephone; that is, it transmits sound waves—speech and music—from one point to another point. The telephone employs electrical currents, guided over conducting circuits of copper wire to transfer the sound energy.

These copper wire telephone circuits confine the transfer of sound to a definite selection of sending and receiving stations, making the connection private. Telephone circuits are, moreover, of the two-way type, in that either party may both talk and listen.

The electrical current which carries sound energy along a telephone wire is a certain kind of alternating current, peculiar in that the frequency of the alternations changes for every different sound of speech or note of music.

To distinguish this current from other kinds of alternating currents, it is called the "voice frequency" current. In telephony, then, the sound waves which strike the telephone transmitter or microphone are transformed from sound energy into voice frequency currents of electricity; these voice frequency currents travel along wires to the telephone receiver, and in passing through the receiver they are reconverted into sound waves.

Sometimes these voice frequency currents of electricity are called "audio frequency" currents, which simply means that if these currents are transformed into sound energy, they will make audible sounds, sound waves that affect the sense of hearing.

Voice frequency currents are also used in radio broadcasting, but in radio there are no wires connecting the transmitter to the receiver. In this respect the radio broadcast system differs, as it comprises a central transmitting station sending out electrical waves in all directions, the same as the spreading waves from the point where a pebble is dropped into a quiet pool of water.

These waves are created by a second kind of alternating current, which alternates at a steady frequency so high that it is inaudible to the human ear, but which creates the electrical waves that carry the voice frequency currents through space. This second type of alternating current is called the "carrier current," because it creates the carrier wave which transports the program from the transmitter to the receiver without wires. It is generated by an oscillator.

Then the voice frequency (audible) currents are superimposed upon the carrier (inaudible) current in what is called the "modulator," and the modulated current, impressed upon the transmitting antenna, creates electrical waves.

The striking of the antenna of a receiving station by these electrical waves, sets up minute electrical currents that are strengthened in the receiver and converted to sound waves of the desired loudness to satisfy the listeners. Any number of receiving sets can collect the signals from this one broadcast station, the only limitation being that the spreading electrical waves actually reach and strike the antenna before becoming too faint to actuate the receiver.

The electrical frequency of the carrier current determines the frequency, or wave length, of the station. Other broadcast stations on different wave lengths employ different electrical frequencies for the carrier currents. The broadcast range includes frequencies between 550 kilocycles and 1,500 kilocycles.

24. Revision and completion of a paragraph. The following sentence is a condensed statement of an idea suitable for development in a paragraph of thought.

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Technological unemployment is doubly unfortunate, since it not only reduces the total number of jobs but displaces many skilled workers who are too old to adapt themselves readily to new machines and methods.

This idea is partially expanded in the paragraph below, but the thought is not fully developed. The choice of words for logic and emphasis could be greatly improved. Write a paragraph developing the same idea. Take as many suggestions from this paragraph as you wish, but add other material which you believe to be needed.

Unemployment of any sort stands out as the most tragic problem of our present economic order. And certainly that type which is due to mechanization improvement is doubly poignant because, for one thing, many of the workers who are displaced by new equipment are the older skilled craftsmen above the "forty-year dead line." Their livelihood has for decades come from their own trained dexterity. It is for this reason that it is all the more difficult for them to find jobs. Even the operation of the new machines which have replaced the ones to which they were accustomed calls for the faster fingers and quicker eyes of youth.

25. Development of paragraph ideas. Write a paragraph of thought suggested by one of the following passages. Give your paragraph a title.

a. No one ever developed for me the relation of any required subjects to those that attracted me; no one brought out the relation of anything that I was studying to anything else, except, of course, to that wretched degree. . . .

The unknown is the province of the student; it is the field for his life's adventures, and it is a wide field full of beckonings.

—LINCOLN STEFFENS, *Autobiography*, I., 119

b. The eighteenth century has acquired a reputation for skepticism; but this is a mistake. In truth there has never been a less skeptical age. Its beliefs were rigid, intense, and imperturbable. In literature, as in every other department of life, an unquestioning orthodoxy reigned.

—LYTTON STRACHEY, *Lecture on Pope*

c. Some people are transported, like packages; others really travel.

d.

Locomotive

Across the parchment of the earth

You scrawl with hissing pen

The autograph of industry—

The manuscript of men.

—STELLA WESTON

e. Laziness, the true mother of invention, has contributed much to progress throughout the centuries by inspiring the development of labor-saving machines and devices. (Do not mark this statement "true" or "false," but test its soundness, and set forth your conclusions in a reasoned paragraph.)

26. Paragraph unity and structure. The following examples illustrate the best modern practice in paragraph writing. The writer treats his subject with ease and freedom. He avoids the monotony and artificiality of regular topic sentence beginnings but nevertheless achieves unity of thought and effect.

(1) Supply a topic which represents the central thought of each paragraph.

(2) Sum up the thought of each paragraph in a single sentence, keeping the proportion and emphasis shown by the paragraph as a whole.

A

Architects now approach their work from a totally different angle from that of the past. For six thousand years Egypt, in building, had only one structural principle—the post and lintel; Greece, following, used the same structural principle, though with a refinement and system of detail and proportion that has never since been equalled; Rome introduced the masonry arch in combination with the post and lintel; and until fifty years ago, in spite of all the changing styles, these were the only structural principles employed. Then came steel, and with it skeleton construction, now used throughout the Western world. It has made possible the piling up of storeys to great heights; by enabling work to go forward on many floors at once, it has permitted very rapid building. And the machine, concentrating as it does the energy of thousands of its slaves, now allows the erection in one year of structures surpassing in extent of space those that resulted from centuries of labor by thousands of workmen.

B

The taking over by society of duties once divided among a multitude of individual homes, requires large and specialized buildings, a condition intensified by the swollen populations of our cities. Hospitals, such as the new Presbyterian Hospital in New York, are needed to care for the sick. To keep residence and business near together requires great apartments, and the scarcity of domestic help makes such co-operative living thoroughly desirable. With increased wages and the eight-hour day, theatres are called upon to accommodate crowds. In education, for which the demand is enormous, the influence of the tall building can be seen at the University of Pittsburgh, which has planned a skyscraper to house its halls of learning.

C

Given a need for large buildings, it is fortunate that size can be achieved more practically by piling masses up than by spreading them out. The vertical is always more attractive than the horizontal; it produces an effect of slenderness that is more pleasing. We have vertical stripes on our clothes

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because we think they add to our appearance. And, conversely, how are ugly clothes—clothes that we do not want copied, the uniforms of convicts—how are such clothes designed? They have broad horizontal stripes. No one would willingly wear anything so hideous. In his buildings, too, man has liked lines that accentuate height and carry the eye upward. Previously, although handicapped by solid masonry construction, he has been fascinated by the majesty and pleasing lift of high buildings. In the Gothic, designed to raise all eyes towards Heaven, he realized his ideal with marvellous feats of engineering. Yet structural difficulties with it were so great that this vertical style did not have much influence on the non-religious architecture of its period. Steel, however, has made every building potentially as high as its designer pleases.—CORBETT, H. W.: *New Heights in American Architecture—Yale Review*, pp. 691–693, July, 1928 *

27. Smoothness in paragraph structure. Revise the following paragraph to improve the sequence and connection between sentences.

To a large extent the old-fashioned, all-round mechanic has been made unnecessary by the introduction of automatic machinery. Boys of eighteen can be taught to operate these machines. The old apprentice system has been replaced by a "vestibule" school or some other form of intensive training for shop employees. The automobile industry is especially noted for simplifying processes and dispensing with skilled labor. It hardly seems likely that we shall ever be able to dispense entirely with skilled labor. Some way must be found to encourage young men to take up training that will make them real mechanics and not merely machine operatives.

28. A problem in paragraph construction. Read carefully Stevenson's discussion of how one should learn to write. Then test his theory by trying to write one or more paragraphs in the style of Macaulay, Huxley, and other authors, including Stevenson himself. Try to copy not only the pattern, the sentence form and the choice of words but also the rhythm and the spirit of each writer whose works you imitate. Place the original and the parody side by side, as in the following imitation of a paragraph from Stevenson:

Extreme busyness, whether at school or college, kirk or market, is a symptom of deficient vitality; and a faculty for idleness implies a catholic appetite and a strong sense of personal identity. There is a sort

Extreme sanitation, whether at home or abroad, betokens a lack of physical and mental vigor; and a cheerful disregard of germ dangers indicates a robust constitution and a sound nervous system. There is a

* Used by permission of the author.

of dead-alive, hackneyed people about, who are scarcely conscious of living except in the exercise of some conventional occupation. Bring these fellows into the country, or set them aboard ship, and you will see how they pine for their desk or their study. They have no curiosity; they cannot give themselves over to random provocations; they do not take pleasure in the exercise of their faculties for its own sake; and unless Necessity lays about them with a stick, they will even stand still. It is no good speaking to such folk: they cannot be idle, their nature is not generous enough; and they pass those hours in a sort of coma, which are not dedicated to furious moiling in the gold mill. . . . This does not appeal to me as being Success in Life.

(From *An Apology for Idlers*. Used by permission of Charles Scribner's Sons.)

sort of germ-fearing, hypochondriacal people about, who can hardly venture upon the most commonplace activity without uncomfortable awareness of bacteria. Take a walk or a street-car ride with such persons, and you will see how they surround themselves—and you—with a host of invisible enemies. They have no pleasure in the open air, which they feel to be merely a storehouse of contagion; they cannot endure the contact of fellow-passengers, many of whom suggest imminent danger of contamination; even the sunlight, by reflecting the dust particles, serves only to convince our germophobiacs that their fears are well founded. It is no good remonstrating with such folk: they cannot be sanguine, their spirits are not bold enough; and they pass those hours in a sort of germ-haunted uneasiness, which are not devoted to aggressive measures of antiseptic precaution. . . . This is not what I should call the "Joy of Living."

29. Specifications for paragraph construction—Bain's rules. No better summary of the requirements for the paragraph can be found than that which was made by Alexander Bain, the Scotch rhetorician, about the middle of the nineteenth century. His quaintly phrased rules are almost comparable to engineering specifications in their definite and comprehensive treatment of the subject. Study Bain's laws as quoted below, and test the paragraphs of Macaulay on pages 108-111 by each rule in turn. Write a summary of your conclusions.

1. The first requisite of the paragraph is, that the bearing of each sentence on what precedes shall be explicit and unmistakable.
2. When several constructive sentences iterate or illustrate the same idea, they should, as far as possible, be formed alike. This may be called the rule of Parallel Construction.
3. The opening sentence, unless so constructed as to be obviously preparatory, is expected to indicate with prominence the subject of the paragraph.
4. A paragraph should be consecutive, or free from dislocation.

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5. The paragraph should possess unity; which implies a definite purpose and forbids digressions and irrelevant matter.

6. As in the sentence, so in the paragraph, a due proportion should exist between principal and subordinate statements.

30. Malapropisms. The misuse of a word may range all the way from a ridiculous and self-exposed blunder to a comparatively slight departure from the best possible synonym. This obvious truth might be stated in the reverse order, but experience suggests that people work gradually upward from a point of little or no discrimination. A careful writer's choice among words is guided not only by his knowledge of their meanings but also by his feeling for their associations. Test your sensitiveness to the wrong or the less fitting word by criticizing the following expressions. If you object to a word, you are obligated, of course, to substitute a better one.

a. Frequent inspection of the brakes insures a reasonable amount of safety.

b. "A difference between American and German student life," said the visiting professor, "is that the German students live close together—they are concentrated in one place—and American students are dissipated all over the town."

c. When I have finished my engineering course I should like to build a monstrous dam.

d. The machinists and other laymen passed through the factory gate on their way from work.

e. One man, who was very conversant, did most of the talking while the others listened.

f. To the uninitiated, the analysis of steel seems an insurmountable process.

g. The book contains so many technical terms that only a connoisseur of aeronautics could understand it.

h. This method of refining enables the use of low-grade ores, which were formerly wasted.

i. Having so much at stake, the public utility companies do not wish to depend upon the vagaries of politics.

j. The dormitory is composed almost entirely of engineering students.

31. The origin and history of words. Every one is interested to some extent in philology. The uneducated workman wonders why a particular tool is called a "canthook" when, as he says, "that is the one thing it *can* do." The student's curiosity about words may be aroused by the discovery that a common technical term such as "kilovolt-ampere" preserves the names of two scientists, an Italian and a Frenchman, at the same time that it employs

a Greek root which is indispensable to the metric system. Perhaps he chanced upon the information that "an orange" was once "a norange" or that "a nickname" was originally "an eke-name." Such inquiries into language history are fascinating and profitable.

Following the suggestion contained in the discussion of "parachute" look up ten words which have piqued your curiosity and whose origin you would like to know for your own satisfaction. If you are not already familiar with all of them, you may wish to include some of the words in the list cited below.

The seeming resemblance of the "parachute" to "parallel," "paragraph," and similar words, is misleading. In fact, "parachute" comes from the French and has nothing to do with the Greek prefix "para," meaning beside or equal. The first part of the word (cf. *para* in *parasol*) is found slightly altered in the familiar fencing term "parry," meaning to ward off or protect. The second part, "chute" is familiar as a separate word which is readily associated with the idea of falling.

WORDS SUGGESTED FOR INVESTIGATION

aerobatics	macadamize
algebra	microfarad
binomial	panchromatic
dactylogram	phagocyte
diesel	philatelist
dinosaur	robot
heliotherapy	seismograph
kenotron	tessellated
laitance	thesaurus
lithograph	viscosimeter

32. Derivative words—a list of negative prefixes. Many writers and speakers are troubled by the large group of derivative words which begin with negative prefixes. The difficulty is not so much with the "*non-*" and "*dis-*" words, since these are rather specialized in meaning and are comparatively little used. The more puzzling words are those which include either the Latin prefix "*in-*" with its variant forms ("*il-*," "*im-*," "*ir-*" etc.), or the Anglo-Saxon prefix, "*un-*." Flagrant instances of the wrong form are, of course, readily detected. In "*She Stoops to Conquer*," for example, Mr. Hardcastle, who is instructing his awkward servants in decorum, says: "You must watch us eat and not think of eating." Diggory replies, "By the laws, your worship, that's perfectly *unpossible*." We smile at honest Diggory's blunder. His crude language seems

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quite in accord with his general lack of training. From this obvious example of the wrong prefix the question of choice may range through a sliding scale of difficulties until we encounter such disputed forms as "insanitary" and "unsanitary," concerning which there is much to be said on both sides. The following list of words is intended as an offhand test of the student's familiarity with the correct form, and of his promptitude and confidence in choosing it. It is primarily a measure of his acquaintance with the spoken word, since the test to be applied is whether a particular form *sounds* right.

- | | | |
|--------------------|---------------------|-------------------|
| 1.—accessible | 35.—decisive | 69.—partial |
| 2.—adequate | 36.—decorous | 70.—penetrable |
| 3.—advertent | 37.—demonstrative | 71.—practiced |
| 4.—alienable | 38.—determinate | 72.—predictable |
| 5.—alterable | 39.—dignified | 73.—prepossessing |
| 6.—appeasable | 40.—dignity | 74.—prevailing |
| 7.—apposite | 41.—distinguishable | 75.—propitious |
| 8.—appropriated | 42.—divided | 76.—provident |
| 9.—assailable | 43.—divisible | 77.—rational |
| 10.—auspicious | 44.—doubted | 78.—regenerate |
| 11.—believable | 45.—dubitable | 79.—relenting |
| 12.—biased | 46.—effable | 80.—refragable |
| 13.—calculable | 47.—effective | 81.—relevant |
| 14.—cautious | 48.—eligible | 82.—salubrious |
| 15.—civility | 49.—ending | 83.—satisfiable |
| 16.—clement | 50.—equal | 84.—scrutable |
| 17.—cognito | 51.—equality | 85.—significant |
| 18.—coherent | 52.—equivocal | 86.—sobriety |
| 19.—commensurable | 53.—eradicable | 87.—solicited |
| 20.—comparable | 54.—exorable | 88.—sophisticated |
| 21.—compatible | 55.—fallible | 89.—souciance |
| 22.—conclusive | 56.—gainly | 90.—subordination |
| 23.—congenial | 57.—glorious | 91.—substantial |
| 24.—considerate | 58.—hospitable | 92.—surpassed |
| 25.—conspicuous | 59.—imitable | 93.—temperate |
| 26.—contestable | 60.—judicious | 94.—terminable |
| 27.—controvertible | 61.—legal | 95.—transigent |
| 28.—conventional | 62.—manageable | 96.—valuable |
| 29.—corporeal | 63.—offensive | 97.—variable |
| 30.—corruptible | 64.—operative | 98.—vertebrate |
| 31.—credible | 65.—opportune | 99.—veterate |
| 32.—curious | 66.—ordinate | 100.—vulnerable |
| 33.—decided | 67.—ostentatious | |
| 34.—decipherable | 68.—paralleled | |

Examine the differences in the quality or emphasis of negative forms of the same word. For example, note the distinction between *unsatisfied* and *dissatisfied*. Which seems more appropriate in the closing lines of Louis Untermeyer's poem *Prayer*?

"And when, at last, the fight is won,
God, keep me still unsatisfied."
(dissatisfied)

Which word does Untermeyer use? Test other cases similarly by using each word in a suitable context.

33. Idioms. Among the many passages in Lord Chesterfield's correspondence that have practical interest for present-day readers is one in letter LV concerning the observation of idiomatic forms in language. He says to his son:

There is one fault in your letter, but such a one as many older persons than you are would have committed. It is where you say, that I may not accuse you *with* being one of the Tubs of the Danaids; whereas you should have said *of*, instead of *with*: *of* comes always after accuse, and *with* after reproach. Thus, suppose it were possible for me to suspect that you were ever giddy; I must either say, I accuse you *of* giddiness, or I reproach you *with* giddiness.

A living language is characterized by the use of many such fixed expressions, or "idioms" which seem at times to defy both grammar and logic. We may not be able to explain why certain phrases exist, but we do know that usage requires the use of words in these special combinations. Any departure from the traditional form immediately attracts attention. Thus, when a foreign-born student writes, "I was prevented to attend class," we are immediately conscious of awkwardness in his phrasing. His meaning is intelligible, but his language is unnatural. As we have seen (page 96), the smoothness of a sentence may depend largely on the writer's knowledge of accepted idioms.

The choice of a particular combination of words is not only a question of smooth or awkward phrasing. Sometimes a writer's use of a particular idiomatic form represents a conscious purpose to express a precise shade of meaning, as in the differentiation between such phrases as "on behalf of" and "in behalf of," "differ

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from" and "differ with," and "consist of" and "consist in." Although much of our feeling for idiomatic language is acquired incidentally and without effort, such distinctions as these require close attention.

The following exercise is intended to test the student's ear for the correct idiom as well as his discrimination where differences in meaning are concerned.

Fill the blanks below with appropriate prepositions.

The difficulty of the problem consists _____ its length rather than its complexity. The apparatus used in the experiment consisted _____ the following. The first problem does not differ _____ principle _____ the second. Any property entrusted _____ me will receive the best of care. We did not look _____ his offer with favor. I greatly appreciate the honor that has been conferred _____ me. You can count _____ my support. He took advantage _____ my mistake. He is an authority _____ the subject of fossils. You have no authority _____ saying that. His aversion _____ hard work is well known. The authorities connived _____ the violation of the law. He compared the government of the United States _____ that of Great Britain. Life may be compared _____ a voyage. He is unwilling to encroach _____ another's rights. He takes great pride _____ his knowledge. We have positive proof _____ his guilt. They show no regard _____ his feelings. He is a slave _____ greed. They subsist _____ a plain diet. We are at variance _____ our friends. He has no taste _____ work. He is accountable _____ this act _____ me alone. This act is quite foreign _____ his character. He is amenable _____ reason. He was charged _____ perjury. He has not yet found the key _____ the mystery. He is quick _____ figures. The plane will leave the field _____ twenty minutes. We could see _____ a glance that an accident had occurred. He is tired _____ waiting _____ an answer. They were not easily reconciled _____ the situation. His money is invested _____ bonds.

Angry _____ his friends; blessed _____ good health; contingent _____ favorable news; impervious _____ water; pursuant _____ your inquiry; secure _____ harm; suited _____ the occasion; subversive _____ discipline; absolved _____ guilt; irrelevant _____ the question; preferable _____ the other; easy _____ access; occupied _____ his studies; apprised _____ the fact.

34. Review of idioms and verb forms. Insert the appropriate verb or preposition in the spaces indicated by letters.

1. If the enclosed folder proves unsuited _____ (a) _____ your needs, we _____ (b) _____ be glad to send you a different size in exchange _____ (c) _____ it.
2. If you _____ (d) _____ find, on checking over your requirements, that you could use a gross of these containers at a time, we _____ (e) _____ like an opportunity to submit a special price on them.

3. The superintendent requested us to let him know (f) our records (g) be completed by July 1.
4. The latest date (h) filing applications is next Wednesday, July 6. No deviation (i) this rule (j) be made without The Committee's permission.
5. If the necessary precautions had been (k) before the machine (l) operated, this accident (m) not have occurred. (*m. Express the idea of impossibility*)
6. You (n) be notified within the next week if any changes (o) made in these prices.
7. We understand (p) you (q) consulted our Chicago representative regarding the terms on which these goods will be shipped.
8. As soon as we (r) your letter we looked up the date on which your order (s) been filled.
9. Such an arrangement as you suggest (t) possibly have been made if the specifications (u) reached us before work on the machine (v) started.
10. I (w) not know for several days whether the plan that you propose is feasible. Meanwhile, if you find the enclosed modifications acceptable I hope that you (x) indicate your approval. I shall appreciate (y) telegraphing your decision.

35. A vocabulary list. Read carefully the articles in a current issue of any one of the following magazines: *The Atlantic Monthly*, *Harper's*, *Scribner's*, *The American Mercury*, *The Yale Review*. Add to these magazines if possible such foreign publications as *The London Mercury*, *The Fortnightly Review* and *The Round Table*. Note any words which are unfamiliar to you or which are used in a sense that is new to you. Quote enough of the original sentence or phrase to illustrate the meaning and the use of each new word. Make a list of the words, and then, having in mind the context in which you encountered them, use each one in a sentence of your own. Your list should resemble in its general nature, if not in its length, the one given on pages 141 and 142.

36. Synonyms. As an offhand test of the number of synonyms which you have within call, try the following ten-minute exercise. Opposite each word in the left-hand column, write at least as many synonyms and antonyms as the numbers in parentheses indicate. Be sure that each word which you use is the same part of speech as the one to which it corresponds. Do not use a derivative of the base word; that is, do not obtain antonyms by prefixing *un*, *dis*, *in* (*im*), or *non* to the base word. Since exactly fifty words are re-

quested, you can readily compute your score after the instructor has crossed out the unacceptable words.

BASE WORD	SYNONYM	ANTONYM
<u>talkative</u>	<u>garrulous, loquacious</u>	<u>reticent, taciturn</u>
a. joy	(3)	(3)
b. honest	(2)	(2)
c. brave	(2)	(2)
d. old	(2)	(2)
e. work, <i>verb</i>	(2)	(2)
f. large	(5)	(5)
g. rich	(3)	(3)
h. rapid	(2)	(2)
i. plentiful	(2)	(2)
j. polite	(2)	(2)

37. Definitions. Criticize the completeness and consistency in form as well as the soundness of the following definitions and differentiations. Point out any that do not seem to be definitions at all, and explain why. If a definition is indicated or illustrated but not expressed, state it explicitly in your own language. Complete the unfinished definitions.

a. The popular distinction between speculation and legitimate business is misleading. Gold mining is a very speculative business, but is perfectly legitimate. Farming is highly respectable and legitimate, though somewhat speculative. Operating a faro bank is illegitimate, but not at all speculative; for, in the long run, the bank is sure to win.

b. A classic is a work to whose faults we have become blind.

b'. A classic is something that can be simple without being vulgar, elevated without being distant; that is neither ancient nor modern; always new and incapable of growing old.—Lowell

c. Success is the perfect reaction between effort and achievement.*

c'. Success is the irony of ambition attained.

c". Success is the attainment of an objective in which a dominating egoistic urge obtains a fullness of expression which is both personally gratifying and socially beneficial.

d. Unity is sticking to your subject.

e. Arson is where you burn a house.

f. An amateur in sport is a person who through lack of ability or lack of experience holds a non-professional position in the sport world.

g. Elasticity is the direct proportionality which exists between unit stress and unit deformation.

* Definitions c, c', and c" originally appeared in a competition conducted by THE FORUM.

h. A farce is a type of drama in which probable people are represented as doing improbable things.

i. The chief distinction between a tool and a machine is _____.

j. An essay is a piece of prose that is not definitely something else.

38. Effective use of words.

a. Point out examples of effective use of words in the following quotation:

WHISTLER'S WRITING

His style never falters. The silhouette of no sentence is ever blurred. Every sentence is ringing with a clear vocal cadence. There, after all, in that vocal quality is the chief test of good writing. Writing, as a means of expression, has to compete with talking. The talker need not rely wholly on what he says. He has the help of his mobile face and hands, and of his voice, with its various inflections and its variable pace, whereby he may insinuate fine shades of meaning, qualifying or strengthening at will, and clothing naked words with color, and making dead words live. But the writer? He can express a certain amount through his handwriting, if he write in a properly elastic way. But his writing is not printed in facsimile. It is printed in cold, mechanical, monotonous type. For his every effect, he must rely wholly upon the words that he chooses, and on the order in which he ranges them, and on his choice among the few hard-and-fast symbols of punctuation.

He must so use those slender means that they shall express all that he himself can express through his voice and face and hands, or all that he would thus express if he were a good talker. . . . Whistler was that rare phenomenon, the good talker who could write as well as he talked. Read any page of "The Gentle Art of Making Enemies," and you will hear a voice in it and see a face in it, and see gestures in it. And none of these is quite like any other known to you. It matters not that you never knew Whistler, never even set eyes on him. You see him and know him here. The voice draws slowly, quickening to a kind of snap at the end of every sentence, and sometimes rising to a sudden screech of laughter; and, all the while, the fine fiery eyes of the talker are flashing out at you, and his long nervous fingers are tracing extravagant arabesques in the air. No!! You need never have seen Whistler to know what he was like. He projected through printed words the clean-cut image and clear-ringing echo of himself. He was a born writer, achieving perfection through pains which must have been infinite for that we see at first sight no trace of them at all.

MAX BEERBOHM: *Yet Again*, pp. 114-116. By courtesy of William Heinemann, Ltd.

b. Quote a passage that you have discovered in which the writer shows effective use of words. Explain your reasons for choosing this example.

ORAL ENGLISH

Since oral English is largely concerned with the sound and meaning of individual words, it may be conveniently classified under "vocabulary." In a broader sense, however, we have been dealing with oral expression from the beginning. Even a seemingly mechanical task such as punctuation is found to be largely a matter of *listening* for the needed pause and emphasis. The practical test of correct grammar, as we have seen, is not to apply rules but to note whether a sentence *sounds* right. The same test, with emphasis on the writer's appreciation of rhythm and movement, determines whether a sentence has variety, smoothness, and cadence. Oral English is thus an indispensable auxiliary to the study of written composition.

Notwithstanding these obvious truths, oral expression is widely neglected. Reading aloud, it seems, is becoming a lost art. People have grown to be "eye-minded," forgetting that language consists primarily of sounds and pauses, and only secondarily of written symbols. A student once testified that he had studied calculus for a long time before it occurred to him to pronounce the word "i-n-t-e-g-r-a-l," and then he was doubtful of its accent. Possibly a good many persons have formed the habit of reading by the "skim and scan" method, in the hasty, preoccupied fashion of a man who divides his attention between breakfast and the morning newspaper. As a means of studying, no less than as an aid to writing, the student will find it worth his while to cultivate the neglected art of reading aloud.

If the student has opportunity to take a special course in effective speaking, so much the better. Even apart from this instruction and in connection with his regular studies, he can learn much by giving attention to the three principal aspects of oral English, namely: *pronunciation, enunciation,*

and *inflection*. The first of these has to do with the correct sound of words; the second, with the distinctness of their utterance; and the last, with their combination and emphasis to convey a given shade of meaning. The exercises given below are intended to suggest an approach to study and practice which may be carried as much farther as the student's needs and inclinations may suggest.

39. **Pronunciation.** The moment a man begins to speak, his pronunciation either recommends him or gives him away. If he is confident and sure in uttering his words, the audience is the more impressed by his ideas. On the other hand, if he picks up his words in a gingerly, uncertain fashion, or worse still, if he confidently and ignorantly mispronounces them, the audience will probably think more about him than about what he has to say. A speaker who really knew his subject was once discussing the respective functions of the engineer, the architect, and the contractor. His audience apparently did not challenge him on the last of these three words (it is a case in which usage defies the dictionary accent), but his pronunciation of "artch-i-tect," as he gave it, caused a wave of consternation to pass over the assembly. As he repeated the word, the expression of bewildered surprise among his listeners gave way to mirth, which was none the less genuine for being politely suppressed. The audience began to watch for the recurrence of the word as they might for a gag in comedy. When the speaker unwittingly threw in "discreetion" for good measure, the amusement, intensified by crowd psychology, was almost beyond the control of courtesy. Unfortunately, the audience went away forgetting the content of a good discussion and remembering only the speaker's entertaining mispronunciation of a few words.

To guard against being placed in the position of either the hesitant or the blundering speaker, every student will do well to take stock of his pronunciation. Nor need any one assume that he can follow his life work as a silent partner in industry, with no obligation to express his ideas orally. Every one who is capable of producing articulate sounds is sooner or later compelled to make a speech. Consequently, the thing for all to do is to get ready.

A word of caution may be entered here against extreme self-consciousness with regard to pronunciation. Purism and *pré-*

ciosité are more objectionable in spoken than in written style. The ease and naturalness which contribute so much directness and force to spoken language necessitate a certain amount of flexibility in speech. Such variations as dropping the final r's (not the initial h's) or shading one's a's and o's, if unaffected, may add charm and interest to speech. Only, beware of extremes. Do not pronounce "constitute" with a "toot," but on the other hand, do not exaggerate the long "u" sound in the manner of the old-fashioned elocutionist who plaintively inquired about "What has become of our little boy b-l-ē-ū?" with a definite separation of sounds. In other words, use discretion.

The one hundred words given below are those which appeared most often in a list contributed by the students in several classes. Many words that were submitted are not found in this group. Geographical names, for example, such as "Colorado," "New Orleans," and "Los Angeles," might well form the nucleus of a special list. Words like "encomium" and "preventive" represent problems of spelling or observation rather than questions of pronunciation. Others, like "either" and "detail" offer a choice between acceptable accents or vowel sounds. Such words as "euthanasia" and "Hyperborean" are rather too special to be included in a list that is designed for everyday use. The examples which have been retained are fairly common words that have proved troublesome either because they are difficult to enunciate or because confusion exists regarding the sound or accent that should be given them.

- | | | |
|-------------------|-----------------------|-------------------|
| 1. acclimated | 18. bourgeois | 35. dirigible |
| 2. acoustics | 19. brusque | 36. discretion |
| 3. address (n.) | 20. carton | 37. drama |
| 4. admirable | 21. ceramics | 38. economic |
| 5. adult | 22. chassis | 39. efficacy |
| 6. alias | 23. chauffeur | 40. encore |
| 7. allies | 24. comparable | 41. finance |
| 8. alternative | 25. consummate (adj.) | 42. forehead |
| 9. amateur | 26. conversant | 43. formidable |
| 10. apparatus | 27. coupé | 44. genuine |
| 11. applicable | 28. cylindrical | 45. habitual |
| 12. architect | 29. data | 46. harass |
| 13. attacked | 30. deficit | 47. herb |
| 14. auspices | 31. demonstrate | 48. hereditary |
| 15. automatically | 32. deprecate | 49. heterogeneity |
| 16. beneficent | 33. derogatory | 50. horizontal |
| 17. beneficiary | 34. dessert | 51. hospitable |

52. hydrometer	69. maintenance	86. project
53. illustrate	70. mischievous	87. recess
54. importunate	71. municipal	88. regulate
55. impotent	72. nonchalant	89. recognize
56. impracticable	73. often	90. repertoire
57. inexorable	74. patronize	91. research
58. inextricably	75. penalize	92. romance
59. integral	76. peremptory	93. seismograph
60. irreparable	77. phraseology	94. stationery
61. irrevocable	78. pianist	95. statistics
62. isolated	79. practicable	96. superfluous
63. kilometer	80. precedence	97. theatre
64. laboratory	81. precedent	98. valet
65. levee	82. preferably	99. vaudeville
66. literary	83. prelude	100. vehemence
67. library	84. process	
68. macadam	85. program	

40. **Enunciation.** People vary so widely in their ability to utter words and syllables distinctly that every one who has difficulties may be said to constitute an individual problem. The causes and types of faulty enunciation are numerous, and of course they differ greatly in degree. Sometimes there are physical defects which cause initial "s" to be spoken in a lisping way or omitted entirely. Sometimes the explanation is habitual carelessness, causing intermediate syllables to be slighted or possibly to be merged, as if held together by real or imaginary chewing gum. With some persons a tendency to stammer, or perhaps a fear of stammering, prevents clear enunciation. Then there are certain words which every one finds more or less difficult to speak distinctly. A case in point is the word "statistics." Some speakers try to substitute "facts," "data," "tabulated information" and other synonymous expressions. However, the word is unavoidable and the thing to do is to master it and other difficult words as soon and as completely as possible.

The following passages are suggested for reading aloud:

(a) The insidious incipency of the deceased person's disease deceived expert diagnosticians and precluded the prompt prescription of preventive measures.

(b) Inextricably interwoven with the statistics among which they are interspersed, these data constitute merely a heterogeneous mass of economic information concerning our late allies. Any one who is conversant with the situation will recognize the futility of trying to isolate facts which are directly applicable to the project under consideration.

Even though such a congestion of difficulties may never be found in actual speech, the attempt to speak these words distinctly will prove worth while as a test of one's enunciation.

41. **Inflection.** The following discussion of "Oral Reading" is excellent, not only as a statement but also as an illustration of the relation between the spoken word and the living thought. Read the passage aloud, taking care to use the tempo and inflection and emphasis that will convey the author's exact meaning. In interpreting the logic of his discussion you will necessarily demonstrate the sort of oral punctuation which he recommends.

There is probably a direct connection between the ability to read well aloud and the ability to read well silently. If you do not read aloud intelligently and intelligibly,—and have no physical impediment,—your friends may fairly wonder whether you read to yourself intelligently. Certainly if you read well aloud, translating vividly your author's meaning into your voice and your inflections and your pauses, they have certain evidence that you at least know how to read with sense and appreciation anywhere.

The foremost need in the reading of other people's matter is naturalness; and the chief content in naturalness is variety. Variety shows vertically—in pitch and range; and horizontally—in speed.

Naturally we use a considerable vertical range in making our speech expressive: especially is this true of the most natural human animal, a little boy or girl. If you have a three-year-old in your family, let him be your tutor in natural voice-range. But your prosy adult irons out of his reading all significant emphasis and rise and fall that would make it vivacious and expressive; and drones on in a monotone that would put even him to sleep but for the pumping of his diaphragm. Any matter that is to be mentally understood must be mentally interpreted; the best speech does this interpreting by means of varied pitch and emphasis and inflection of voice; and the best oral reading uses precisely the same means—there are no substitutes.

The other form of variety which speech and reading make use of is horizontal—in rate. Here is the other "worst" offence of bad oral reading: it grinds out the same number of syllables per minute, though the heavens fall. Such reading is an operation that can mean nothing to man or beast. All true speech constantly varies its speed; tripping quickly over a phrase (like those last three words), then pausing lightly; holding a strong word so all shall hear it; varying the movement with a delicacy far beyond the expressiveness of any punctuation ever devised; yet with such natural ease that toddlers at home master all its real principles before ever they learn to read.

Now of course all this natural variety appears in our reading of others' ideas only so far as we have thought those ideas into our own minds. That is really the whole story. We need not have thought them independently; we need not believe them; but if we have thought them clearly after the writer,

we can hardly read them unintelligently. And if we read them aloud at all, the most rudimentary courtesy suggests that we translate them into speech that will be justly and fairly expressive.—H. R. SHIPHERD in *Manual and Models for College Composition*, Ginn and Company *

The following questions concerning details of the passage will serve to test the closeness of your reading.

1. What two words in the first sentence receive the greatest emphasis? How do they divide the sentence into two corresponding and approximately equal parts?
2. The idea in one of these words is repeated in the second sentence, but in different language. Explain.
3. What difference in the meaning and emphasis would be made if the phrase "at least," in the last sentence of the first paragraph were set off with commas?
4. In the first half of the third paragraph the pronoun "him" occurs twice. Do you emphasize this word strongly in either or both cases? Why? Justify your answer by reference to the logic and form of the context.
5. In the first sentence of the last paragraph, what expression corresponding to "others' ideas" calls for special emphasis? What three expressions later in the paragraph explain the meaning of this first sentence, partly by telling what is not meant and partly by telling what is necessary? Locate these three phrases by noting the logical emphasis required in oral reading.

42. Examples of style. Even a very brief passage may indicate the style of the text from which it is taken. Examine each of the following excerpts and comment on the kind of style exhibited. Point out what you consider to be the good or bad qualities of each specimen.

a. The most casual reflection will show that our language is all the time turning its nouns into verbs without scruple, and with very good effect. How are we to shoe a horse, crown a king, feather our nest, iron clothes, water a garden, air a room, or smoke a pipe, if we are not to turn nouns into verbs?

b. When the writer assumed charge of this department he noted that there were several ways in which the efficiency of the workers could be increased. Many parts of the equipment were not being utilized as fully as possible and in some cases it was found that the members of the staff were not doing the work for which they were best suited. Some changes have been made in the arrangement of equipment which have resulted in greater convenience to all the employees. In reorganizing the various departments we have made many similar modifications which have improved conditions. By making these specific changes in each department we have secured the greatest possible economy and efficiency.

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c. In compliance with your request we beg to advise that we do not have a parts catalogue covering our machines. It has been our custom during the past several years to stamp a symbol number on every part of our machines and when replacements are required, all that is necessary is to give the symbol number and the serial number of the part and the machine.

d. In proportion as the manners, customs, and amusements of a nation are cruel and barbarous, the regulations of their penal code will be severe.

d'. In proportion as men delight in battles, bullfights, and combats of gladiators, will they punish by hanging, burning, and the rack.

e. Mr. Linker presented himself—the phrase is a most unpleasant one. No self-respecting writer would use it if he could find any other to express his meaning. He would prefer to say ‘Mr. Linker arrived’ or ‘Mr. Linker came.’ Or perhaps ‘Mr. Linker turned up’ or ‘blew in.’ Unfortunately, ‘presented himself’ is the only way of describing the unctuous politeness, the self-satisfied smugness, the deprecating humility and the formal correctness with which Mr. Linker, at the Manor House door, asked for Lord Colavon. It is therefore necessary to use the words.

f. No attribute of travel is more important than safety. Any consideration of the subject which does not take this factor into account is incomplete.

g. A frequent cause of noisy gears in the truck transmission is the presence of a new pinion which is forced to mesh with an old gear. The one which has seen long service is necessarily somewhat lacking in its denticulation, and gives audible evidence of its resentment at being compelled to do further duty, especially when associated with a companion gear to whose contour it is not habituated.

h. Asleep on an Atlantic City verandah at three in the afternoon . . . a grown-up in a chair slumbering like an infant in a cradle! . . . slept nine hours last night and now at it again! . . . nothing wrong, only recuperating from overwork in the City . . . had a date for golf and has forgotten all about it . . . sleeps oblivious of the chatter at the bridge tables . . . dreams of solutions to problems that he left behind . . . stirs at three-thirty, blinks the life about him and nods off again . . . just a business man caught napping at Atlantic City . . . but you'll never catch him napping in town!

i. Every person, firm or corporation, who shall sell or furnish for use in, with or for the sale of any goods, wares or merchandise, any trading stamps, coupons or other similar devices, which are given free with the purchase of any goods or exchanged for any labels or trade-marks of manufactured goods and redeemed for money, premiums, or other values by individuals or corporations organized for the purpose of such redemption and who are not manufacturers of products for which they are given or exchanged, shall before so furnishing or selling the same, obtain a separate license from the treasurer of the county wherein such furnishing or selling shall take place.

j. Jammed into the acute angle between two high fences, where the rhythmic play of my arms, in tune with that of several other pairs, but at a dire disadvantage of position, induced a rusty, a quasi-extemporized old engine to work and a saving stream to flow, I had done myself, in the face of a shabby conflagration, a horrid even if an obscure hurt; and what was interesting from the first was my not doubting in the least its duration—though what seemed equally clear was that I needn't as a matter of course, adopt and appropriate it, so to speak, or place it for the increase of interest on exhibition.

(Experience as a voluntary fireman)

43. Semi-technical exposition. In the manner of Francis Leupp's explanation of direct and alternating current (page 151) write a paragraph of semi-technical exposition on one of the following subjects:

Catalytic Action
Corrosion
The Hydraulic Jump
The Artificial Horizon
The Function of a Carburetor
Electroplating
Hydrogenation
Electrolysis

44. Comparison and criticism of style. In two translations of plato's *Republic* the same passage is rendered quite differently. Criticize the style of the two passages. Which do you prefer, and why?

A

Socrates and Glaucon

Socrates (*loquitur*)

After these things, said I, assimilate, with reference to education and the want of education, our nature to such a condition as follows. Consider men as in a subterranean habitation, resembling a cave, with its entrance expanding to the light, and answering to the whole extent of the cave. Suppose them to have been in this cave from their childhood, with chains both on their legs and necks, so as to remain there, and only be able to look before them, but by the

B

Socrates. Glaucon.

(Socrates:) And now, I said, let me show in a figure how far our nature is enlightened or unenlightened: Behold human beings living in an underground den, which has a mouth open towards the light and reaching all along the den; here they have been from their childhood, and have their legs and necks chained so that they cannot move, and can only see before them, being prevented by the chains from turning round their heads. Above and behind them a fire is blazing at a distance, and be-

chain incapable to turn their heads round. Suppose them likewise to have the light of a fire burning far above and behind them; and that between the fire and the fettered men there is a road above. Along this road, observe a low wall built, like that which hedges in the stage of mountebanks on which they exhibit their wonderful tricks.

I observe it, said he.

tween the fire and the prisoners there is a raised way; and you will see, if you look, a low wall built along the way, like the screen which marionette players have in front of them, over which they show the puppets.

I see.

45. Collection of specimen passages. From your own reading make a collection of five extracts approximately as long as those quoted in Exercise No. 42. Indicate the type of style represented by each example and explain the peculiarity or special merit which led you to choose each passage.

46. A graphic chart, or "Progress Record," for the criticism of manuscripts. At the first meeting of the class the instructor may ask each student for a brief but specific discussion entitled, "My Difficulties in English." Such an assignment or its equivalent is well worth while. It reminds the student that the course is intended to help him in solving his writing problems. It leads him to center attention on his own particular difficulties and thus prepares him to apply what he learns in the classroom. It gives the instructor a basis for a preliminary survey of his class, for of course he will add to the difficulties listed a number of others not recognized by the student but revealed incidentally in his writing. From this tentative inventory both the student and the instructor can estimate the rate and extent of the progress made later in the course.

The student's difficulties may be analyzed most conveniently if they are indicated graphically. On a chart representing the whole range of problems in composition each member of the class should locate the areas which concern him in particular and which call for special study. Data for a cumulative record will be obtained from the criticisms made by the instructor on successive manuscripts. After the first quarter of the year, when the characteristic difficulties of each student will have been fully identified, the mistakes should become progressively fewer and the manuscripts should be credited with specific points of excellence.

For each error, place a vertical tally mark at the left and under the appropriate subheading, for example:

I. Page layout

||||

Excellence may be indicated by a conventional check mark (✓) at the right.

MECHANICAL FORM		ORGANIZATION		PARAGRAPHS		SENTENCES		VOCABULARY (STYLE)	
Ms., abbr. num., p. sp.		cl., ch., v. c., tr., E.		cl., ch., v. c., tr., con., sm.		cl., v. c., s. l., s. l., s. l., s. l., s. l.		www. Rep. Coll. Bull. etc.	
<u>Manuscript</u>		<u>Purpose</u>		<u>Purpose</u>		<u>Purpose</u>		<u>Accuracy</u>	
1. Page Layout		16. Clearness		31. Statement		46. Central Thought		61. Definiteness	
2. Legibility		17. Directness		32. Discussion		47. Pattern		62. Concreteness	
3. Neatness		18. Consistency		33. Connection		48. Emphasis		63. Aptness	
<u>Abbreviations</u>		<u>Outline</u>		<u>Unity</u>		<u>Unity</u>		<u>Variety</u>	
4. Correctness		19. Basis		34. Completeness		49. Completeness		64. Range	
5. Appropriateness		20. Sequence		35. Selection		50. Restriction		65. Selection	
6. Consistency		21. Subordination		36. Consolidation		51. Consolidation		66. Freshness	
<u>Runarals</u>		<u>Unity</u>		<u>Structure</u>		<u>Grammar</u>		<u>Appropriateness</u>	
7. Exact numbers		22. Completeness		37. Pattern		52. Completeness		67. To Content	
8. Enumerations		23. Selection		38. Development		53. Consistency		68. " Reader	
9. Approximations		24. Consolidation		39. Conclusion		54. Reference		69. " Purpose	
<u>Punctuation</u>		<u>Coherence</u>		<u>Connection</u>		<u>Logic</u>		<u>Consistency</u>	
10. Comma		25. Logical order		40. Sequence		55. Completeness		70. In Tone	
11. Hyphen		26. Chronological		41. Direct Reference		56. Consistency		71. " Logic	
12. General		27. Transitions		42. Implied Reference		57. Clearness		72. " Diction	
<u>Spelling</u>		<u>Emphasis</u>		<u>Smoothness</u>		<u>Smoothness</u>		<u>Effectiveness</u>	
13. Observation		28. Space		43. Sentence Length		58. Idiom		73. Directness	
14. Pronunciation		29. Position		44. Sentence Form		59. Variety		74. Conciseness	
15. Definition		30. Headings		45. Transitions		60. Movement		75. Originality	

47. Criticism and revision of compositions. Using the same symbols as are given in connection with the revision of manuscripts on pages (170-183), indicate the faults in the following passages. Point out and discuss the principal difficulties with regard to general plan, purpose, structure and style. Add whatever comment you think appropriate.

A

The material used in making the steel is mostly scrap iron. The iron is stored in large quantities in the yard. This yard has a net work of railroad tracks, which facilitates the handling of the scrap iron. A number of the tracks run under an electric crane. The scrap is picked up by an electromagnet, fastened on the crane, and placed in oblong tubs. These tubs are on small trucks—three tubs to each truck. When all the tubs are full, the trucks are hauled up in front of the furnaces, they being at right angles to the furnaces. This machine has a large arm which is fitted into a socket on the end of the tubs. The arm is revolved, thus discharging the load of iron into the furnaces. The tubs are then withdrawn and placed on the truck again.

B

In revolutionary war times soap making was a household art. Each house wife had to save up the fatty scraps of the Kitchen and leach wood ashes to obtain potash or lye. The fundamental reaction has not changed, that of decomposing fats with lye to make soap.

The next step in the industry was the village soap and candle maker. He would make a house to house canvas for fat scraps. Benjamin Franklin's father was a soap and tallow chandler. But no industrial prominence was reached until Le Blanc in 1792 invented a process of making soda from salt.

Artificial alkali were first introduced in soap manufacture in 1823 made according to the Le Blanc process. Like all new processes, the purer soda of the Le Blanc process was manufactured for some time before getting into prominence in soap making. All stages of new processes have similar stages of distrust. The manufacture of solid soda was started in 1854. In 1857 Thompson invented sheet iron kettles, which greatly exceeded the heavy cast iron.

As a result of the unsanitary and certain technicalities of the Le Blanc process, there grew the ammonia process by the Solvay Bros. 1860. The Solvay process is nearly all ionic reactions.

Another factor in the manufacture of soap on the commercial scale is the large meat packing houses of the Middle West. These great concerns produce enormous amounts of tallow a year.

Last but not least is the mechanical equipment, automatic machine, steam heating and the by products. In some firms the by-product that of glycerin is now the main product, an economic advantage and making soap secondary because of the higher price of the former as compared with the latter.

Therefore in summary we have four factors which to a great extent are

responsible for the size of the soap industry, viz., Le Blanc and Solvay processes of soda making, big packing center, improved machinery and by products.

48. Justifiable fault-finding. Criticism that is not favorable and appreciative is sometimes looked upon as essentially ill-natured. Although merely carping criticism is not to be encouraged, a certain amount of fault-finding is undoubtedly a good test of any one's standards of expression. The critic's reaction need not, and should not, be abusive; but upon occasion, it may well be emphatic. It is a good sign when a reader becomes indignant upon comparing a poor piece of writing with the better composition that might have been written on the subject. After the manner of the example quoted below, write a detailed criticism of some selection that falls conspicuously short of excellence.

OUR SUMMER COTTAGE

Our cottage is nestled cozily at the foot of a hill overlooking the lake. The water is as clear as crystal and the sunrise over the eastern horizon is simply beautiful. Two tall oak trees stand like sentinels in front of the cottage and beyond is a little boat house where our canoes and a motor boat are kept secure from the ravages of waves when a storm comes, as it sometimes does, although nearly all the time the weather is simply delightful. The green foliage along the hillside makes the spot delightful to the eye. The cottage has a large porch completely screened to guard against the possible encroachments of mosquitoes and the interior is furnished with all the comforts of home.

"nestled"—is trite
 "nestled cozily" is even more trite
 "overlooking"—does it refer to the hill or to the cottage?
 "clear as crystal"—worn simile
 "sunrise"—superfluously placed on the eastern horizon
 "simply"—ecstatic, but not expressive
 "stand like sentinels"—trite simile
 "beyond is boathouse"—shift in point of view (place)
 "when a storm comes"—shift in point of view (time) also negative suggestion
 "although nearly all the time"—further shift in time point of view
 "simply delightful"—again assertive and evasive
 "kept secure"—the purpose of the boathouse is too obvious to require stating
 "green foliage"—the color note is elementary information
 "delightful to the eye"—is once more evasive
 "has a large porch"—mention without the emphasis of a formal statement. ("Is" and "has" are preferably avoided in description)
 "completely screened," etc.—the purpose of screening is unnecessarily explained
 "mosquitoes"—negative suggestion
 "and the interior"—not an "and" relationship. Note the shift in point of view, porch to interior
 "all the comforts of home"—a final touch of trite, evasive language, a climax of amateurishness

49. Note-taking—"contents" form. Using d "contents" outline for subject matter like that indicated below, write up a set of notes on a lecture. In addition to setting down the main divisions and the principal subordinate parts of the lecture, include striking

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statements here and there which impressed you as having special interest. These inserted comments are a good indication of your alertness in watching for details and of your inclination to follow up certain parts of the lecture for your own satisfaction. The notes as a whole are a measure of your creative listening or reading.

ENGINES AND BIG PLANES

Plane engines are lighter than other engines in proportion to power.

- | | | |
|--------------------|----------------|------------------------|
| 1. Liberty engine. | 2. Air-cooled. | 3. Snider Race engine. |
| 3 lb./hp. | 2.75 lb./hp. | Less than 1 lb./hp. |

Liberty Engine

12 cylinder, water-cooled
V-type (90°).

Curtis D-12

12 cylinder, water cooled
V-type (60°).
British obtained privilege of manufacture.
Used in pursuit planes, 160-165 m.p.h.

The present Rolls-Royce engine is an outgrowth of the D-12.

In 1923 an American team of fliers using a D-12 raced against England and Italy. The American team won because of a narrower fuselage and metal propellers. With the use of the D-12 engine the width of the plane is determined by the width of a pilot's shoulders.

Endurance of Engines

Engines are expected to last long; e.g., Fokker transport plane. Three engines, 150 hours. Forced down because of faulty lubrication at the rocker-arm. The rocker-arm push-rod wore down $\frac{1}{2}$ inch and caused trouble.

Endurance record; 538 hours.

Engines still good when pilots were ordered down.

Causes of trouble

Fuel lines
Lubrication system
Ignition system

The Diesel engine eliminates this cause of trouble.

Cooling system.

The advent of the air-cooled engine eliminates this cause of trouble and decreases weight, but the air resistance is increased.

Tachometer

An instrument for measuring velocity.

Falling of the tachometer hand warns the pilot of trouble.

Trouble causes increased friction among parts, thus decreasing the speed of the plane.

"It is not true that you can tell how the engine is running by the sound of it."

50. The preparation of a paper. Collect a tentative bibliography (cf. pp. 247-248), gather material and prepare an outline for a paper on some phase of any subject in the following list or on another subject which meets the instructor's approval. After the bibliography and the outline have been accepted, write a paper ten or twelve pages in length summarizing the results of your reading. The earlier stages of your paper may represent a collection of scattered notes, but your final draft should be closely unified and smoothly and consecutively written. Use quotation marks for passages that you have taken over verbatim and give the source of all borrowed material. Indent the longer quotations and write them in single-space type. The bibliography which accompanies your final draft should consist only of works which you have found useful.

SUGGESTED SUBJECTS FOR PAPERS

Automatic Stokers	Landing Gear for Aircraft
By-products of Coke Manufacture	Mechanical Refrigeration
Color Photography	Motorization of Cavalry
Cosmic Rays	Photoelectric Cells
Diesel Engines for Aircraft	Radio Advertising
Electrification of Steam Railways	Superchargers for Airplanes
Forest Conservation in the United States	Television
Grinding Machines	The Thirteen Month Calendar
Industrial Safety Work	Unemployment Insurance
Insulation of Residences	Welding versus Riveting
	Workmen's Compensation Laws

51. Graphic presentation of data. Verify the accuracy of the following statistics on "Scheduled Air Transport Operations in the United States." Construct graphs to show the relationship between data of the same kind over a period of years.

	1927	1928	1929	1930	1931
Planes	144	294	619	637	753
Passengers	12,594	52,934	165,283	385,910	412,819
Scheduled miles flown	3,922,304	10,472,024	20,242,841	28,833,967	42,653,513
Employees	840	1,740	4,430	6,350	7,401

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Look up statistics on both air mail and air express, and suggest a graphic form for the presentation of each. Show the location of the principal air lines. Your report as a whole may be considered a graphic story of commercial aviation between 1927 and 1932.

52. News articles. The news articles in technical journals, though usually brief, are typical of their kind. The purpose of such articles, whether found in daily newspapers or elsewhere, is to give a clear, concise statement of facts. The writer deals with a specific piece of information, in connection with which he answers the usual questions of who, what, when, and where, by supplying details which the reader wishes to know. A subject suitable for a news article might be the authorization of bids for a new section of highway, the meeting of a group of engineers, or the installation of new electrical or mechanical equipment. Despite the number and variety of details, the article is built around a central subject, and its parts are given in a definite sequence. The style of such articles, although impersonal, is brisk and straightforward. No better exercise in writing can be found than the preparation of a news story based on data which the writer has collected and has checked for accuracy.

a. Examine several current issues of technical journals and pick out a news article which meets the requirements of its type.

b. Collect first-hand information concerning a meeting, a construction project, or some other matter of present interest. Put your data in the form of a compact news story.

53. Descriptive articles. The descriptive technical article, which is longer and more detailed than the news story, contains both facts and explanations. The news story would state, for example, that a dam or a bridge costing a certain amount would be built at a given time and place, by a certain company or municipality. To this information the descriptive article would add an explanation of the type of dam or building, with illustrations and detailed dimensions, and would give an account of the special engineering features of the project. It is evident that the writer of such an article must recognize their meaning and their technical importance. Since the descriptive article is the kind most commonly found in technical journals, a number of good examples for study may easily be obtained.

a. List five titles of five descriptive articles which have appeared in current technical magazines.

b. Read one of the descriptive articles carefully and summarize your reasons for choosing it as a representative example of the type.

54. Report articles. A special but important kind of technical article is that which deals with a scientific investigation. A typical subject for such an article, for example, "Volatility in Motor Fuels," is suggestive of a comparative study according to scientific principles of testing. The material for this type of article resembles the data which would be used in a laboratory report or a thesis. The problem of writing, too, is similar, in that the purpose is to set forth the results of a research project. The difference is chiefly in the method of treatment. The writer of the article must carefully select and condense his material and he must present it in the form of a connected story instead of a series of formal divisions. Since the reader is interested mainly in the conclusions reached, the part of the report which deals with results is emphasized. The method and procedure of the tests need not be given in great detail. Because they are a quick and sure method of presenting comparative numerical data, graphs are regularly used in the report type of article.

a. List the titles of five report articles appearing in current technical magazines.

b. Comment on one of the articles, with special reference to the author's statement of the problem, his explanation of the method of attack, and his summary of the results.

55. Discussion articles. Summarize the thought in two editorials which deal with the same subject. Quote significant passages if you like. Comment briefly on the differences between the editorials. The following brief example of a student report will serve to indicate the method. The student has quoted extensively from the first editorial, but at least he has acknowledged the source of the wording.

LET THE BUYER BEWARE

The writer of this editorial points out that conditions to-day are almost the exact reverse of those which prevailed in 1920. "Then," he says, "the seller was in the saddle and he rode with a sharp spur. You paid his price or did without. It is the buyer who is on top these days. He cracks the whip. He pits seller against seller. He says: 'That's all I'll pay.' In a great many cases, it isn't nearly enough. By doing this he is

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helping to create and perpetuate a vicious circle which lowers living standards, increases unemployment, tends to reduce the quality and, in the end, is bound to put his own business on the rocks."

DESTRUCTIVE BUYING

This editorial illustrates the result of selling below cost to obtain a contract or close a deal. It shows that the supplier must reduce the worker's wages and buy cheaper material to fill the contract and at least make his cost of production. The writer also maintains that the buyer should never patronize a concern that sells below cost, since it will cost the buyer in the end.

The writers of these two editorials are agreed in their opposition to what one of them aptly calls "destructive buying." Both are convincing in their argument. The first one gives a new meaning to the old Latin phrase, *caveat emptor*, by suggesting that the buyer needs to beware of his own short-sighted bargain hunting. The second, although phrased in terms of the buyer, emphasizes the idea that the seller who cuts prices is an undesirable member of the business world. An even better title for this editorial might be "Destructive Selling."

56. Library problems for investigation. Look up the answers to the following questions. In connection with each answer, give the source of your information. Be sure to give full data, such as the publisher of a book and the place and date of its publication, the given name or initials of each author, the full title of each work cited, and complete details concerning each article (see pp. 248-249). If the information could not be found, tell where you looked for it, and prove that the possibilities of finding it were exhausted.

1. Has the library any books written by Robert A. Millikan?
2. In what book did you find the most recent information on "Television"?
3. Find six articles published since 1930 on any one of the following subjects: Chromium Plating; Municipal Airports; Electric Welding; Safety on the Highways; Diesel Engines.
4. Locate the source of these quotations:
 - a. Young men are fitter to invent than to judge; fitter for execution than for counsel, and fitter for new projects than for settled business.
 - b. Absence of occupation is not rest,
A mind quite vacant is a mind distressed.
 - c. When Bishop Berkeley said, "There was no matter,"
And proved it,—'twas no matter what he said.
 - d. That tower of strength
Which stood four-square to all the winds that blew.
 - e. Life is as tedious as a twice-told tale
Vexing the dull ear of a drowsy man.

5. Who is president of the National Safety Council?
6. Get the principal facts concerning any two of these men: H. G. Wells; Charles M. Schwab; Sinclair Lewis; Frank Brangwyn; Daniel Chester French.
7. Look up the area and population of Poland; her form of government; her leading industries; her principal exports and imports.
8. May one be said to be disillusioned if he holds an unfavorable opinion which proves incorrect? Distinguish between "illusion" and "delusion," and cite a synonym for each.
9. What is the derivation of the words "monolith," "abiogenesis," "phlebotomy," "conglomeration," "inframaxillary"?
10. Report briefly on two of the following: Bali; Monet; Delian League; Pterodactyls; Magnetic Axis.

57. Original library problems. Having in mind the type of information found in each of the following reference sources, ask a question to be looked up under each one. Your questions should deal with information that you would like to obtain for your own satisfaction. After your list of questions has been approved, consult the appropriate reference works and fill in the answers.

1. The Card Catalogue
2. The Readers' Guide, The Engineering Index,
or The Industrial Arts Index
3. Engineering Abstracts, or Social Science
Abstracts
4. A dictionary of quotations
5. The World Almanac
6. Who's Who?
7. The Statesman's Year Book
8. An unabridged dictionary
9. A dictionary of synonyms
10. An encyclopedia

58. Literary and historical allusions. A good offhand test of one's cultural background is his recognition of literary and historical allusions. These indirect references, buried as they are within the text, compliment the reader by taking for granted his acquaintance with their source and meaning. If he does not place them, the reader can extend his range by the simple process of looking them up. Identify as many as possible of the allusions cited below. Verify the sources of those concerning which you are doubtful or uninformed.

a. Brevity is the soul not simply of a jest, but of wit in its finest sense where it is identical with wisdom.

- b. In a manner worthy of the Great Doctor himself, she asked, "Sir, what size should a mastiff pup attain by the age of six months?"
- c. Thus ended an eventful day and evening, and so to bed.
- d. If the battle flags of Europe are ever furled it will be the work of a very different parliament from the one which is now in session at Geneva.
- e. Stage-designing is not what most people think it is—a branch of interior decorating. Everything that is actual must undergo a metamorphosis, a kind of sea-change, before it can become truth in the theatre. Stage designing is addressed to the mind's eye.
- f. Carlyle was fond of relating a story about a pupil who was asked in a history examination to tell something of Oliver Cromwell. The pupil wrote: "Oliver Cromwell was a man of some importance in English history who was heard to say on his deathbed, 'I wish I had served my God as I served my king.'"
- g. Modern sin lacks the familiar tokens of guilt. One misses the dramatic setting, the time-honored insignia of turpitude. Fagin and Bill Sykes and Simon Legree are vanishing types.
- h. A heart accessible to pathos, to natural beauty, to religion, was a chief requisite for the protagonist of Victorian literature. Even Becky Sharp was touched—once—by Amelia's moving distress.
- i. He had not the loud laugh that spoke the vacant mind, but his laughter was hearty, sympathetic, and contagious.
- j. The author of *Andrea del Sarto* and *Rabbi Ben Ezra* has abundant optimism, but it is not of the Pollyanna sort; it is based on faith and striving, and not on credulity or make-believe.

59. Comparison and criticism of descriptions.

a. After you have read or heard read the two selections, "Sema-phore" and "Telephone," from Joseph Husband's *America at Work*, write a criticism of each and a comparison of the two descriptions. Tell what you think to be the writer's purpose in each one, and how far you think he has achieved it. Recall examples of accurate observation, of vivid, image-making phrases, and of pictures that stand out clearly as a result of the author's word-painting. From the standpoint of purpose, point of view, and total effect, compare Husband's sketches in words with Joseph Pennell's etchings of industrial scenes in his *Pictures of the Wonder of Work*.

b. Recalling Joseph Husband's approach to the subject, try a description of a steel mill, a construction project, or some other industrial scene with which you are familiar. Try to present a clear picture of the scene with emphasis on its artistic, rather than its technical, interest.

60. Original description. Try your hand at a personal description of a scene or an action which you recall vividly and with

pleasure. Perhaps the example quoted below will remind you of a parallel subject for your purpose. This composition was written in response to the assignment: "Write a specific description suggested by the general topic, 'What I Should Like to be Doing.'"

THE TAKEOFF

I can easily picture what I should like to be doing at this moment. In imagination I have already reached the flying field.

I put on my fur-lined flying suit and go out to untie the ship from the stakes. After inspecting the motor and brace-wires, and filling the tanks with gas, oil and water, I am ready to take the air.

The blocks are put under the wheels and one of the mechanics appears from the shop. He whirls the propeller a few turns to charge the cylinders with gasoline vapor; then he shouts, "contact." After I answer with "contact," he gives the propeller a quick throw, and jumps clear. With a sudden burst of flame and smoke the great motor roars into life. I allow it to idle at about eight hundred revolutions per minute until the temperature gauge on the dashboard reaches 140°, then slowly increase the speed to be sure that it is turning up its required number of revolutions. The tachometer climbs—1200—1350—1450 and up to 1800, where the moan is deafening and the ship is straining to take the air.

After throttling the motor back to idling speed again, I nod to the mechanic, who removes the blocks. I push the throttle a bit and the plane rolls forward slowly. A glance at the wind cone shows me that the wind is from the east, necessitating a takeoff out over the high-tension line and the railroad. Having reached the west end of the level grass runway, I turn the rudder and the ship obeys instantly, swinging into position with her nose pointed east. I pause a minute to be sure that nothing has been forgotten.

A slight gust of wind rocks the ship, calling, challenging me to be up on its buoyant stream, so I push the throttle all the way forward. The great plane gathers momentum slowly, but finally begins to get a lift under her wings at about forty miles an hour. A few hillocks on the runway send her into a series of long, gentle bounces, at each of which she is less inclined to return to the earth. Finally, she rises. Shall I miss the wires? I pull back gently on the stick, and the ship responds majestically, pushing her nose toward the clouds. I cross the wires with a hundred feet to spare, and after gaining enough altitude for a turn, I circle back over the field to wave good-bye at the boys who watched my takeoff. Then I bank again into the wind. The earth, already far below, falls away and becomes more flat. Details lose distinctness. The river valley flings itself far down between the hills. Presently a haze begins to come between me and the earth. The altimeter records 2000 feet. Ahead floats a white, fleecy cloud, and around me are many more. Above them is a "ceiling" of grayish ones, into which the ship soon thrusts an inquiring nose. I climb through these and into the eternal sunshine above.

61. Original plot. Drawing upon your experience or imagination, or both, write the plot of a story which, so far as you know, has not been written. The following suggested plot for an incident story may serve as an example.

A short story which I should like to write some time is based on an actual experience of a young man I worked with for a while in the Pittsburgh Produce Yards of the Pennsylvania Railroad. The story would run somewhat as follows:

Tom Sharp, a young man with a keen interest in farming was attending one of the big universities of the East, taking an agricultural course. During the summer of his junior year, he obtained a job as inspector of perishable freight at the produce yards of a near-by city. Part of his work was to look after shipments of bananas. His job was to get in the cars as soon as they arrived and determine the amount of damage, if any, for which the railroad might be held responsible, such as rot from improper icing, or disease from the sides of the car.

One day, while he was far back in an ice-cold car which was scheduled to be moved or "forwarded" to a northern city, the door of the car was suddenly slammed shut and locked. After shouting until he was hoarse, Tom started to hammer on the heavy, heat-insulated door, but before he could raise help, the train started to move.

There being insulation in the car, so that the cold air could not escape, he knew he could live no longer than a few hours in the intense cold. Knowing there was a small plug a little above the floor of the car to release water in case the car should become flooded from the melting ice, he dug his way through the heavy bunches of bananas until he reached it. By pushing with the handle of his hammer, which every inspector carries to open boxes, he forced the plug out. Then, although in the pitch-dark, he tore several sheets of paper from his notebook and wrote messages giving the car he was in. These he shoved through the small hole every time the train stopped or slowed down as though passing through a city. After his paper was all gone, with no answer to let him know whether they had been noticed, he found himself getting drowsy, and it was not long until he had lost consciousness.

He did not come to life until several hours later, when he was lying on the floor of a railroad signal-tower house, with a strange man rubbing his arms and saying, "Be quiet now and the doctor will soon be here."

He learned afterwards that a track section hand, noticing the regularity of small rolls of paper along the track had picked one up, and after reading it, had telephoned the news to the nearest tower house. The tower signalman notified the dispatcher, who located the car and stopped the train at the little wayside station where Tom recovered his senses.

62. Criticism of specific poems. Look up J. Redwood Anderson's *The Crane* and Joseph Auslander's *Steel*. What is the chief

interest of each poem, and what is the attitude of each author toward "the industrial scene"? Quote some passages from each that you consider notable for image-making or suggestive phrasing.

63. A test of poetry. Apply the following test to any poem on which you may have chosen to report.

a. Does the poem have a clear central theme and purpose? Does the underlying idea or conception show invention, imaginative curiosity, the "joy of new philosophical discovery"? Is there a freshness and patness of phrasing to suggest the writer's interest in the subject matter, and his eagerness to share his ideas and point of view with his reader?

b. Does the handling of the subject indicate accurate observation? In other words, does the poet show a definite basis of fact and experience, or does he merely combine a group of vague and general images?

c. Is the form artificial or obtrusive, or does it contribute to the total effect without attracting attention for its own sake? Does the writer seem to have control over the technique of his craft? Do you note the absence of forced lines or verse fillers, pedestrian or prosaic expressions, premeditated rhymes, clichés and awkward or self-conscious phrasing of whatever sort?

d. Does the verse have life and progressive movement? Can it be read aloud easily? Is it enjoyed most when read aloud? Does the language guide the reader toward the subtler inflections of meaning, or does it merely supply a pleasing rhythm that lulls his reason to sleep and stupefies his critical sense?

e. Are there any memorable or quotable passages which linger with you because of something beautiful in the sound of the words or something striking in the thought or imagery? Do these passages wear well?

64. Report on collateral reading. After you have read one of the books of fiction mentioned in Chapter XI, write a review giving your personal reaction—an account of what you got out of the book. Be careful to avoid the "encyclopedia stuff" and the deadly, stereotyped manner of the so-called "book report." Do not follow a formula, such as,

The scene of this story is laid in *x*. The principal characters are *a*, *b*, and *c*. At the opening of the story *a* is introduced, etc.

Avoid the perfunctory, usual tone and method. Even the summary of the story should reflect appreciation and interest. The comment is the important part of your review. Another reader may take exception to your criticism, but he will respect your independent thinking and your willingness to go to some extra trouble in order to express your ideas clearly. Perhaps you will disagree with the comment expressed in the following review.

Your attention is called particularly to the writer's style and method.

I do not care for Lewis's general style. He indulges in meanness, pettiness and vulgarity seemingly only because he enjoys "dirt for dirt's sake." Of course, I know one may say that such qualities are found all around us in real life, but in real life they are alleviated by fine characteristics or extenuating circumstances.

Lewis does not give his characters any good attributes. They are deficient in what could be called the common human virtues. Lewis seems incapable of depicting the true beauty that is found in the everyday occurrences of life, which are all that most of us come in contact with. He could never make us enjoy ordinary people as do Hardy, Conrad, Dickens—or several others who might be mentioned. His characters are too ugly, too grotesque.

The fault I find with Lewis is not in his craftsmanship, which, I am willing to admit, is good, but in his approach and his attitude towards life. He delights in taking a more or less perverted specimen of the human race and holding it up as a type. I have lived on Main Street, and it has its generousities. Lewis allows us poor mortals no hope. We are thus and so, and like that we must remain to the end of the chapter—so narrowly circumscribed that no power with which we come in contact can release us.

The one thing in particular which "Babbitt" seems to express is Lewis's own repressed desire to be a regular fellow, which he relieves by this indirect method.

The Babbitts I have come in contact with have all had some fine quality that made one a little more willing to overlook or excuse their blatant egotism. This attribute Lewis has denied his hero, making him an expression of the baser characteristics only.

Like many other synthetic productions, Babbitt is a very tiresome person. He is something from a laboratory, and the other characters are only wraiths seen through his distorted vision. Naturally he does not arouse our sympathies because we do not feel the need for them. Even in the most pathetic scenes we are but slightly moved, feeling that his emotions then are but little more true than in lighter phases.

Too, I think that it would take more than Lewis has indicated (participation in a few cocktail parties, and loosening of home restraints for a few weeks) to make a man acceptable—even in the status of a "well-trained libertine"—to a woman who has previously found him unattractive.

To me, a book should be vital and real. Its characters should cause one to share their thoughts and emotions and there should be an element of beauty to linger as a pleasant afterglow. My primary object in reading fiction is pleasure, with a secondary acceptance of such philosophical wisdom as the story may convey. Descriptive writing appeals to me because it adds to the enjoyment of the book, and that novel from which I get no charming picture is indeed a loss. To give Lewis his due, there is one such spot of vivid beauty in "Babbitt"—the description of the city streets at night.

65. Selection and criticism of reviews. In current issues of magazines mentioned in Chapter X (pp. 244-245) find examples of book reviews which give a clear and comprehensive notion of the contents of the book, and which interpret at the same time the purpose and the spirit of the author. Select only reviews which are interestingly written. The following, although not a detailed review, begins by selecting the points which would be of main interest to any reader.

"Another American book which I strongly recommend is 'From Immigrant to Inventor,' by Professor Michael Pupin of Columbia University. The author is a scientific man of international fame, who was born a Serb in the Banat or military frontier of Austria, then incorporated with Hungary. The book has two interests. I have never met so good and complete an account of the Americanization of an immigrant, and I have never read so plain a story of the growth of modern science told for those who have no knowledge of the subject. But it has in my eyes a merit far greater. The account of life in his native village as a herd boy is written with simple and vivid style which approaches the highest literary art, and this simple and direct method even in his most romantic outbursts of feeling, persists through the book." Cited in *The Book Review Digest*, 1923, Volume, p. 423, from *The Saturday Review*, 136: 475.

66. A waiting list of books for general reading. From the lists of books in Chapter XI select ten which you definitely plan to read next. Using the arrangement shown in the specimen report quoted below, give first a list of your books, then a concise summary of your reasons for selecting each one. Through *The Book Review Digest* you may find reviews of the more recent books. Your summaries should indicate the impressions which you have gained from the reading of these reviews.

MY WAITING LIST

Boccaccio, G.
Cervantes, Miguel de
Galsworthy, John
Hudson, W. H.
Husband, Joseph
Kipling, Rudyard
Lesage A. R.
McFee, William
Pepys, Samuel
Reade, Charles

Decameron
Don Quixote
The Forsyte Saga
Green Mansions
America at Work
Kim
The Adventures of Gil Blas
Casuals of the Sea
Diary
The Cloister and the Hearth

"The Forsyte Saga" heads my list for two reasons; first, it is said to be an excellently written story, and second, it is a long story. I expect a story told with consummate skill, because the "Saga" has been so extravagantly heralded as the greatest work of our best contemporary author. I expect to enjoy the book, particularly because I can look forward to knowing the characters for a long time. I shall have opportunity to watch the people as they live their lives, and I shall be able to experience their emotions, for they will be my most intimate friends.

"Don Quixote" has been a familiar name since my childhood, but it has always been associated with a mental picture of the lanky Don charging a windmill, while his chubby Sancho stared with wide-eyed amazement. Up to now, I have always regarded it as a somewhat pointless child's book. However, it has been recommended so highly in class that I am eager to discover for myself the reasons for the book's ageless popularity.

When I was an office boy, I made a special trip to the library to get "The Adventures of Gil Blas" for my employer. The title suggests thrills and excitement galore; but the fact that it occupied the attention of a high-salaried executive leads me to expect a solid foundation of philosophical observations, with the adventures as an attractive superstructure.

I have chosen "Kim" for variety's sake, to spice the more serious reading. I have read Kipling's "Jungle Tales," and I liked them very much. The tale he tells of an old world counter-part of a modern street gamin surely must be interesting. Quaint expressions of bizarre ideas make his works attractive and stimulating.

"Dynamite" and "Telephone," two representative essays from "America at Work," were read in class. The felicity of expression and the logical succession of ideas make a lasting impression on me. I would like to read this book for its own sake, and also as a model for my own writing.

The "Decameron" is a collection of tales nearly a thousand years old. To have stood the test of time it must possess unusual merit. It has gained a fixed place in classical literature. I must read it.

Pepys' "Diary" is said to be the accurate and complete setting down of a man's life. There is recorded his every action together with his unreserved comments on the actions of other people. I have heard of the book from many people and I should like to be familiar with such an interesting and well-known book.

"Green Mansions" is a story written about a man in the South American jungles and on the savannas of the Orinoco basin. Written by such an artist as Hudson, I know it will be engrossing.

Some New York columnist has said that McFee's sea stories are even saltier than Conrad's. "Casuals of the Sea" is awaited with interest, and not a little skepticism. Better than Conrad?—maybe! We shall see.

I should like to round out my list with "The Cloister and the Hearth." In his gossip on reading, Sir Arthur Conan Doyle gave this book high praise, and he was surely a judge of historical romances. I have been assured that I will find a pretty story, and an interesting one. I am anticipating as much pleasure from this book as from any other on the list.

APPENDIX

SOME PERSISTENT ERRORS

A DESPAIRING professor once remarked concerning a particularly unpromising student that this man had committed all the standard mistakes in the handbooks and a number of highly original ones besides. Such a case, although not unheard-of, is at least exceptional. The besetting faults in the average student's written work are troublesome, not because of their number but because of their stubbornness. Some of them, perhaps, are not recognized as faults until the instructor has called attention to them. Others are known to the student but are more or less habitual, and consequently are likely to appear repeatedly in manuscripts that are hastily written. It is important that each student shall become acutely conscious of his own faults, in order that he may cultivate a strong prejudice against them. He need not label or classify them, though sometimes the stigma attached to the name of a mistake is useful as a means of aiding the student's memory and intensifying his prejudice. He need not always remember a special rule for correcting the errors, provided of course that he can arrive at an improved form by more direct means.

The most practical approach to the revision of faulty expressions is either a specific analogy, as in the right and wrong forms of the handbooks, or a specific and concrete rule of thumb. The average person can remember and can readily apply a rule such as "Place time modifiers at the beginning of the sentence," but few writers can make practical use of a rule stated in the abstract. Contrast with the

example just cited the following rule from an antiquated and rather pedantic treatise on rhetoric:

When two or more substantives, connected by conjunctions, are not appellatives of one and the same person or thing, "a" or "the," if required before one of them, is required before each.

And yet, all that this puzzling statement was meant to do was to inform the student that he should write, "The secretary and the treasurer attended the meeting" instead of "The secretary and treasurer attended the meeting."

In general, the student's prejudice against certain objectionable forms of expression may prove more helpful than any elaborate scheme of rules and theories. Particularly if he possesses, or can develop, a sense of proportion, his reaction to a false note in writing will be immediate and effective. In the same way, his recognition of a better version will often be swifter and more sure than if he arrived at the same conclusion by the more deliberate process of grammatical analysis.

The following list of miscellaneous errors, though by no means exhaustive, is a typical collection of recurring faults from a variety of manuscripts. It is hoped that the student will be instantly aware of each mistake and will be able to reassure himself concerning his own avoidance of that particular pitfall. If the fault comes home to him as one of his own, the moral is sufficiently obvious.

Affirming the obvious. A rather common form of padding, usually done unconsciously, is the assertion of ideas that go without saying. *The goods are now packed in suitable containers to be shipped to customers who have ordered them.* Or note the following impressive statement of a self-evident truth: *Every time the steam is condensed it loses part of its volume.* Perhaps the writer of this sentence should be reminded of the quotation, "Thou sayest an undisputed thing in such a solemn way."

"As" for because. *The third experiment was omitted, as the apparatus could not be set up in time.* The prevalent misuse of "as" in such expressions may cause the writer to lose sight of its legitimate indication of manner or proportion. Note the correct use of "as" in these sentences: *As coal is needed it is brought from the crusher. He did as he was told.* Such a sentence as the one now being written illustrates a further use of "as." With "such," "many," and "same," "as" becomes a relative pronoun.

Awkward combinations of words. *These materials all vary in time of pickling, temperature, hydrogen ion concentration, agitation and charging.* Clumsy phrasing is nearly always obscure. A smoother wording of the foregoing sentence would improve the sense as well as the sound. Sometimes the correction is simply a matter of rearranging the same words, as in the following sentence: *This procedure is, however, in many cases not followed.* Reading a passage aloud will ordinarily suggest the remedy for this fault.

Awkward passive. *Gas is not depended upon entirely, but coal is resorted to at some seasons of the year.* This construction, let us say, should be carefully guarded against.

"Boners." Any instructor or editor has a large compilation of blunders which rival those in the books published for public entertainment. Accident, carelessness, or a temporary aberration may account for many of them, and of course a considerable number are traceable to what Dr. Johnson called "plain ignorance." The student who wrote in all seriousness that he had always found spelling to be his greatest *bugbare*, or the one who referred to *The Cloister on the Hearth* are representatives of a familiar type, which, one suspects, will never wholly disappear. For those who are not entirely hopeless, a careful re-reading of reports and examination papers will cut down the proportion of such mistakes. Perhaps the best general rule for self-criticism is to keep alive a sense of proportion, which really means a sense of humor.

Change in level of diction. The style of a composition is established and is kept uniform by the use of words which are on approximately the same plane of diction. Note the abrupt change from conventional to colloquial style in this sentence: *The object of this experiment was to see how much power it took to operate a blower fan.* A similar violation of consistency, to say nothing

of unity, is found in the following sentence, with its mixture of poetic and matter-of-fact language. *Electricity, the power of the modern age, is furnished to this plant by two generators which are operated by steam turbines.*

Coinage of words. Either by accident or by a stroke of etymological synthesis, a writer may contribute a new word to the language. Frequently the new word is substituted for a related one which already exists, as in the use of "wiseness" for "wisdom." Specimen creations of a more daring kind are such unrecognized words as "hindrous," "formidability," "perseverity," "inarticulacy," and "neglectable."

Colloquial language. Even conversational expressions which are racy and picturesque instead of merely slangy or crude should generally be avoided in written discourse. Note how the phrases which are out of harmony with the context attract attention to themselves. *If you will tell us your requirements, our sales manager will fix you up. Carelessness in determining the proportions of the mixture causes no small amount of grief in the later processing of the material. The parts for this apparatus can be made in the laboratory, so that the whole thing can be made for somewhere in the neighborhood of twenty-five dollars. He figured that no further losses would occur.* (Compare "Change in level of diction.")

Comma splice. *The fibers are now torn apart, this is done by the the beater engines.* If teachers of composition were asked to name the unpardonable sin among violations of good English, the majority of them would probably vote for the comma splice. This fault, it will be noted, is not merely a mistake in punctuation; it is an offence against sentence unity. It classifies the writer with the "sub-grammatical" persons who do not recognize completeness of sentence form.

Connective expressions. Logical connectives, such as "however," "therefore," "accordingly," and "moreover," are indispensable signs of consecutive thinking, but any one who uses them should know exactly what they mean. The political orator whose conclusions were introduced by the ringing phrase, "Therefore, however," was lacking in a proper appreciation of logical connectives. Test your own grasp of these expressions by using them deliberately in the successive sentences of a paragraph. Note whether the two examples given are used correctly in the fol-

lowing sentences. *Cast iron is very brittle and fractures easily. Wrought iron, on the contrary, can stand a great deal of bending stress. Wrought iron is not easily fractured; on the other hand, it is comparatively elastic.*

Crude transitions. *Another thing is that the packing must be tight or the oil will be lost.* Perhaps a parenthetical note on "thing" as an exhibition of limited vocabulary might be added. Almost any other word would be better, both for precision of meaning and for smoothness of transition.

Dangling participle. Notwithstanding its place on every list of proscribed expressions, this fault constantly reappears. An especially common error in technical writing is the following, in which an active participle follows a passive verb: *The planimeter was calibrated using a check plate.* How much more simple is the grammatically consistent version: *The planimeter was calibrated by means of a check plate.*

Discontinuity between sentences. *Vari-colored roofing is made by the sprinkling of different slates over the surface of the shingles while they are being manufactured. The roofing industry is a highly competitive field.* This fault may often appear as a violation of paragraph unity. It represents a lack of clear, sequential thinking. Even a flighty person usually stays with a subject to the end of a given sentence, but there are many who become lost in passing from one sentence to another. The constant use of connective expressions will help to remedy this failing.

"Double-acting" modifiers. A particularly bewildering form of ambiguity in the reference of modifiers is the kind which appears in the following sentence: *Distribution has been changed from selling to wholesalers to retailers.* Of course the general trouble in this sentence is grammatical incompleteness.

"Due to." *The highways have been improved, due to the demand for all-weather transportation.* Many writers have an irresistible tendency to add a loosely related phrase introduced by "due to." If the writer of the foregoing sentence wished to make a direct assertion he could say *"The improvement of the highways is due to the demand,"* etc. "Due to" should be used in the predicate, or not at all.

Elaborate figures—"fine" writing. *If we would hesitate long enough to forge stabilizing tanks to keep our industrial ship on*

an even keel, in the same manner that the ship builders put those devices at the water lines of their ships to keep them from being dangerously rolled and rocked in the terrible storms encountered at sea, we might keep our industries from rocking and spilling millions of workers overboard into the rough seas of unemployment. This example is extreme, but the tendency to produce language of the kind is not uncommon. Perhaps the writer of this almost Ciceronian simile was proud of his achievement.

"Fact that" constructions. *It is believed that the fact that such aid has not always come in the past is simply an indication that our problems have not been made sufficiently clear to our members.* Although sometimes legitimate, the "fact that" construction, is preferably avoided. At best it is bulky and round-about or merely preliminary. Usually a simple expression can be conveniently substituted for it. Instead of saying, "*The fact that he had arrived,*" we may say "*His arrival.*"

Faulty "it" construction. *If a small model of an airplane is put into a wind tunnel and tested, it is possible to determine whether it has been correctly designed.* The "it" construction introduced by "it is possible" is misleading. Since the reader momentarily regards "it" as a regular pronoun, his discovery of the intended construction brings him up with a start. The "it" construction in general is bulky and indirect. If it is used at all, the introductory "it" should be placed at the beginning of the sentence. Thus we may write "*It is advisable to place such expressions,*" and so on.

Illegitimate "and" constructions. *The soap is light and rises to the top of the mixture.* Since "and" is a convenient conjunction, lazy or careless writers use it to express every sort of relationship between the parts of a sentence. In the sentence quoted above, for example, the intended relationship is really one of cause and effect. The soap rises because it is light. In a sentence such as "*I met him yesterday and he told me that he had changed his plans,*" a time relationship is intended. What "and" may legitimately do is to connect equal, or co-ordinate elements. If one is principal and the other subordinate, the "and" is out of place. Or, to put it differently, expressions of cause, time, and manner, or of any other adverbial relationship are not legitimate "and" constructions.

Inattention. A business man who sometimes composed his letters

with his mind partly on other things, dictated the following sentence: "*We are sending you under separate cover a sample can of our best floor paint.*" The phrase "under separate cover" was a stock expression which had become inseparably associated with "sending." The dictating process was more or less an unreflecting habit, so that the writer did not notice anything peculiar about the statement. He was like the student who wrote: "*His book lay open in his hand, but his mind was elsewhere.*" Mistakes of this kind are usually made by people who know better but do not think. Greater alertness is the obvious preventive.

Indefinite "they." *All the materials used in the plant are carefully selected. They make valves from a special kind of nickel.* A possible antecedent, "materials," is at first suggested, but the context shows this interpretation to be impossible. The pronoun "they" presumably refers to some person or organization, but the reference is hopelessly vague. In a sentence like the one quoted, the passive form is better, e.g., "*Valves are made,*" etc. This form not only eliminates the indefinite "they" but also maintains the pattern established by "are selected."

Indefinite "this." *The two valves, although perfect in other respects, were rejected because of slight defects in the castings. This shows the high standard maintained by the inspectors.* The sentence quoted came from the same manuscript as the one containing the indefinite "they." The two cases of faulty reference are, in fact, similar. A good rule for the correction of the indefinite "this" is to supply a noun in each case to complete the intended meaning. Compel yourself to write "this plan," "this method," "this incident," or "this *anything.*" Do not use "this" alone.

Logical inconsistency. *Naturally, the most important unit in a waterworks system is the purifying process.* Although the fault here may be described as "wrong choice of words," the effect is to shift the logical point of view. The two words "unit" and "process" represent different concepts.

Metrical accidents. However much verse may be appreciated for its own sake, its accidental appearance in a matter-of-fact context is startling and regrettable. Note this expression from the beginning of an otherwise prosaic passage in a description of a paper mill. *Over the rollers a felt cloth runs.* Somewhat like Monsieur Jourdain, who had been speaking prose all his life

without realizing it, this writer had been versifying unawares. A related kind of metrical accident is unintentional rhyme, as in the sentence, *If a customer chooses the machine that he uses, he cannot complain, if it turns out to be unsuitable.* Of course the chief trouble with such passages is that they cause the reader to think about the form of a sentence rather than the content.

Misplaced modifier. *The specimens are now prepared for microscopic examination by the following method.* This fault is among the most persistent of all sentence troubles. The writer knows what he means, but he does not look at the sentence from the reader's point of view. Careful re-reading of a manuscript before it is submitted should insure the correction of such mistakes.

Mixing of figurative and literal language. *It is not too much to say that in the near future airplanes will be useful in every walk of life.* The foregoing sentence was the proud conclusion of a fairly good paper on "Uses of Aircraft." The statement was allowed to create an anti-climax because the writer lacked a corrective sense of humor.

Multiple "of" phrases. Beware of two or more "of" phrases which are not co-ordinate. Such expressions are awkward and are unnecessarily bulky. Instead of writing "His lack of knowledge of geometry," why not say "His ignorance of geometry"? Usually the superfluous phrase can be boiled down in some such fashion.

Primer style. Hasty or unpracticed writers often use a number of short sentences to represent a logical relationship that is not fully stated. Basically, this fault is one of sentence unity. The result which it produces may be called "primer style." It is reminiscent of such early literature as *See the cow. The cow can run.* Compare the following example, which was intended, at least, for more mature readers: *Electricity was discovered by the Greeks. They rubbed amber with a rag.*

Separation of verb and auxiliary. Beware of the "suspended construction" which occurs when a verb is separated from its auxiliary. The following sentence is an example: *"A man, placed in this pit, can, while the propeller is revolving, tell whether it is off center."*

Subgrammatical language. If we start at the lower stages of linguistic proficiency we find a type of person who is lacking in

grammatical consciousness or has an undeveloped grammatical sense. A self-made man who has been rather successful, except in his efforts to learn English, is a case in point. He says, "Let's get down to the basic of this matter," without realizing any distinction between adjective and noun. He writes in a business letter: "Evidently there has been some trouble arise." On one occasion he said: "This consideration is of prime factor." Like a person who is tone-deaf and is consequently unresponsive to music, he is deaf to the most elementary requirements of grammatical language. His case, though extreme and exceptional, differs in degree rather than in kind from that of others who belong with him in the subgrammatical stratum. They confuse "who" and "whom," they are bewildered by tense sequence, and they lose their way among the "whiches" of a long sentence. For such persons the study of formal grammar is strongly recommended. This study should be supplemented by abundant practice in reading aloud.

Superfluous adjective clause. *The honesty which characterized him caused him to become known as "Honest Abe."* Compare the more direct form, *His characteristic honesty*, etc., and note the improvement in emphasis as well as in conciseness. Unless the clause form is needed for some special reason, reduce the expression to its simplest terms.

"Tacked-on" expressions. These unwarranted continuations of a sentence are at best a form of loose construction. At their worst, they may violate unity of subject matter. The writer of a paper on history was describing the migration of a group of early settlers. He wrote: *The next day they advanced as far north as Sidney, a town named in honor of the dashing Sir Philip.* His critic said, *They stopped at Sidney; why didn't you?* The question of when to end a sentence is one that troubles a great many persons. It is easy to add an appositive term or perhaps an after-thought in the form of a participial phrase. Watch your sentence endings. If you find many "tacked-on" additions, practice putting your sentences into the periodic form.

The "thereby" construction. A special form of the "tacked-on" construction is one consisting of "thereby" with a participial phrase, for example: *The factory building is three stories high, thereby taking advantage of gravity in the transfer of the various materials in different stages of production.* At best, the con-

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struction is loose, ambiguous, and very awkward. Avoid forming the "thereby" habit.

Unbalanced series. *The manager must know the consumer's needs, forecast demands, and the productive capacity of the plant must be adjusted to potential consumption.* The latter part of the sentence should carry out the pattern established by the first member of the series.

Unsupported "here." *The pulp is now worked over by machines called "beaters." Here it is mixed with water.* The first sentence contains no expressed antecedent term or support for "here." Beware of using this word unless direct reference to a place is indicated.

Unsupported "which." *The foundry workers wear leggings, which is an excellent safety precaution.* No antecedent is provided for "which." The idea contained in the whole statement concerning the foundry workers is an implied antecedent, but the construction is not grammatically complete. The sentence quoted below illustrates a slightly different form of the same mistake. *The bottom of the box is pressed into place, after which it is glued down and heated.*

Unwarranted plural. Do not use a plural verb with a collective noun or with an expression of quantity in which the sum is considered as a whole. In the sentence, *When the liquid had reached the boiling point, 50 cc. of chlorine was added,* is not the chlorine regarded as a quantity? To write "were added" would suggest that one cubic centimeter of chlorine was added at one time. Compare, *Fifty dollars was (not were) paid for this suit of clothes.*

Unwarranted "there" construction. *There are many examples which could be cited to illustrate the working of this principle.* Contrast the simpler form, *Many examples could be cited,* etc. Even though its use is sometimes desirable, the "there" construction is so often objectionable that the student should try to avoid it. Sentences beginning with "there" are characteristically bulky and indirect. To encourage directness and emphasis, newspaper editors instruct their reporters to avoid beginning a sentence with "the." On the same principle, we may formulate the practical rule, *Do not begin a sentence with "there."*

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